AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Published by Howes Publishing Company, 440 Fourth Avenue, New York

Devoted to the practical application of dyestuffs in all industries; especially to textile chemistry—the science and practice of scouring, bleaching, dyeing and finishing.

Volume XIX | NOVEMBER 10, 1930 | Number 19

Emulsions–Their Preparation and Applications

By ALAN A. CLAFLIN

MR. DOOLEY, the brilliant Hibernian philosopher of the Mauve Decade, or Turn of the Century, once observed that while the question of "Trade Following the Flag" might be debatable, he had always noted that Supreme Court discussions followed the Electoral College. Similarly with mild cynicism one may note that technical discussions are apt to follow in lines laid down by commercial developments. The clothes moth presumably was regarded by the woolen manufacturer in as benignant a light as the boll-weevil by the southern planter, who proposed to erect a monument to it as the industry's greatest benefactor. Anyway, the clothes moth was long neglected until a German scientist developed a more or less efficient method for moth proofing woolen fabrics and since then our technical journals fairly teem with micrographs of moth eaten surfaces and poisoned larvae. Likewise surface tension was an indistinct and vague recollection about as familiar to the average textile chemist as the equation of a parabola or binomial theorem until someone discovered that the sodium salts of alkyl aromatic sulphuric acids have great usefulness as wetting agents or penetrants because they lower the surface tension of aqueous solutions. Now everyone talks of surface tension, the surface tension of soap solutions, of carbonizing baths, of the interfaces in foams and emulsions. These examples are not cited, however, in the spirit of unfriendly ciriticism, but rather to forestall such criticism, as the guilty conscience of the author recognizes his interest or perhaps more truly his experience with emulsions comes from the sale of a colloid mill. Unquestionably since that interesting, simple, mechanical device, the colloid mill, has been found to have suitability for the preparation of emulsions for textile uses, the textile industry has heard much more about emulsions than they ever did before. Whether one's interest in emulsions, however, begins with a colloid mill or interest in colloid mills begins with emulsions, the two interests rapidly converge or coalesce. Emulsions are such extremely interesting combinations of matter and the colloid mill makes them so efficiently. To the person who has to do with emulsions but has not used a colloid mill, this story of pre-Volstead days has a certain significance. In one of those centers of joy, not to say dens of iniquity, which even the "Wets" say never will return, but which are felicitously known to memory as the "Poor man's club"—one patron who had reached the conversational stage said to his chance acquaintance in the hope of establishing a community of interest: "Have you ever been in New York?" The answer was "Naw." Again he ventured, "Have you ever been in Chicago?" Again, "Naw." Then he went abroad. "Have you ever been in London?" "Naw." Still unrebuffed, but farther afield. "Have you ever been in Constantinople?" "Naw." Still persistent—"Have you ever been in Shanghai?" "Naw." Finally the worm turned. The untravelled interrogated said "Have you ever had delirium tremens?" The reply was "No," which brought the crushing finale. "Well, you ain't never been nowhere and you ain't never seen nothin'." A great deal that has been written concerning emulsions would not have been written if the colloid mill had been invented earlier and a great deal more will be written concerning emulsions as the colloid mills become more familiar to emulsion makers.

Pharmaceutical Emulsions Made With Mortar

The drug clerk of a previous generation made cod liver oil emulsions in a mortar. His emulsions were permanent and were right every time. The housewife stirred her mayonnaise with a fork, sometimes she had good results, often it curdled or even separated. The principle of the mortar is the principle of the colloid mill, raised, however, to the nth degree. Now before colloid mills were invented certain general observations concerning emulsions had been established, first that emulsions are mixtures of two mutually insoluble liquids, second that one liquid is the internal or dispersed phase and the other the external or continuous phase, third that in addition to the two insoluble liquids for a permanent emulsion, a third

substance must be present, such substance being termed an emulsifier or stabilizer. There has been a good deal of discussion on the efficiency of different types of emulsifier. The cause of divergent opinions lay in the imperfect mechanical means used for emulsification. With the mechanical uncertainties removed by the colloid mill, it may be stated unrevocably that for an oil and water emulsion and alkaline salt of a fatty acid, i.e., a soap is the best emulsifier. Such a soap, however, should be made in course of the emulsification. That is, the fatty acid should be dissolved in the oil and the alkali in the water. There should be an excess of fatty acid over the theoretical equivalent for the alkali used. It does not make much difference whether an alkali is used in the form of hydrate or salt of a weak acid as carbonate or borate, but the presence of such free weak acid is slightly prejudicial to the best results. In considering the reasons for the action of emulsifiers the theory originally promulgated by Helmholtz seems most satisfying. This is often termed the Helmholtz double layer theory. It assumes the concentration of the emulsifier in an interfacial zone which surrounds the individual globules of the dispersed phase. This interfacial zone or film has a positive electrical charge on the interior surface and a negative charge on the exterior surface, further this film acts as an electrical condenser whereby the electrical charges can be accumulated. This accumulation of negative electrons on the exterior surfaces of the dispersed globules tends to make them mutually repellant and the emulsion therefore permanent.

Colloid Mill Emulsions Confirm Helmholtz Theory

The emulsions made with the colloid mill furnish a splendid confirmation of the condenser theory. Assuming the electrical charges are the result of the mechanical energy expended in separating the dispersed liquid into globules, the intensive energy expended in the colloid mill should effect a greater accumulation of charges than the defusive energy expended when emulsions are made by shaking or stirring. This is exactly what is found. Put in an electrical cell the speed of migration of the negatively charged globules of an emulsion made in the colloid mill will be found to be much more rapid than a corresponding emulsion made by stirring or of an emulsion of the self-emulsifying type. This is indicative not only of the smaller size of the globules of the colloid mill emulsion, but in all probability that they actually carry larger charges. It should be easy to determine quantitatively if this observation is true. In the textile industry the present widest use for emulsions is of the oil in water or fat in water type in order to take advantage of the lubricating quality of the oil or fat, but to reduce the quantity that it is necessary to use. An oil only serves as a lubricant when it is in actual contact with a surface, some vehicle must carry it to that surface either excess oil or some other liquid and hence the economy of wherever possible using emulsions. Before, however, considering the lubricating emulsions the colloid mill makes possible another class of emulsions which are relatively new to the textile industry, in fact to all classes of industry, because only since the advent of the colloid mill has it been possible to prepare them efficiently.

Cleansing Emulsions

These emulsions may be termed cleansing emulsions, as their primary usefulness would appear to be in removing the greases and waxes that adhere to the crude fibers. Heretofore the familiar emulsions have been those of heavy oils and fats, but with a colloid mill it is just as simple to emulsify a wide range of volatile solvents. For considerable time there has been an appreciation that volatile solvents in aqueous suspension should be of assistance in removing greasy or waxy impurities from textile fibers. Evidences of this appreciation are the widespread use of fulling oils and scouring oils, kier oils and special soaps that contain some proportion of volatile solvent. Probably the forerunner of these was the housewife who added a few spoonsful of kerosene to her wash boiler or the old-fashioned bleacher who added a small amount of kerosene to his kier. Anyway the idea has extended but many would contend that the advantages claimed from the use of these compounds have not been conclusively demonstrated. A scouring oil is a liquid soap or a neutralized sulphonated oil to which is added as much of some volatile solvent as it will carry without separation. Kier oils are of similar composition. The special soaps differ mainly in that there is more soap and less solvent. The function of the solvents in such compounds is to make more liquid the greasy or waxy impurities as the more liquid they are the more readily they are removed by emulsification. In the case of scouring wool or woolen goods where a considerable amount of soap must be used anyway, it is not necessarily perhaps much more expensive to have that soap incorporated with the solvent although practically if scouring oils are attempted to be bought on a soap content basis, the sellers will generally appear not interested. In the cotton kier the use of any soap, even a rosin soap, is usually interdicted as too expensive and it is felt the alkali alone furnishes what detergent effect is needed in conjunction with the emulsified waxes. The waxes, however, even at the high temperatures employed are none too readily emulsifiable. Ether extraction will demonstrate that a small addition of kier oil will give a cleaner cotton fiber and in a shorter space of time than alkali alone, but in the ordinary kier oil it requires four to five times as much liquid soap or sulphonated oil to carry the volatile solvent as there is solvent and the solvent is really the active agent.

Wide Range of Volatile Solvents Emulsified

With a colloid mill it is a very easy matter to emulsify a wide range of volatile solvents. Such emulsions when made in the proportion of fifty to sixty per cent, three to five per cent emulsifier and the balance water are permanent for several months at least, in fact probably never would absolutely break, but would have some

creaming and some separation of water by syneresis. The use of emulsions of solvents, like xylol, dichlor ethyl ether, ortho-di chlor benzene, that is, fat solvents with a boiling range somewhat above the temperature of the kier, have shown marked economy over kier oils and been equally efficacious in removing ether extractables. For wool scouring reports from practical trials are not yet at hand and for such purpose it is quite likely that the lower boiling solvents as ethylene dichloride or even gasoline emulsions might be used. It is practical to make emulsions even more concentrated than sixty per cent solvent, but such emulsions are pastes and not quite so readily diffusible as the more liquid emulsions. The superiority of emulsions prepared with a colloid mill over emulsions made by stirring or from self emulsifying oils for the purpose of lubricating the wool fiber for carding is so thoroughly established that it would not seem necessary to emphasize it. However, it is an evidence that the textile industry is not as progressive as it should be, when the subject is studied statistically, for probably not over a third, probably less rather than more, of the wool that is carded is lubricated by colloid mill emulsions, yet such emulsions save at least forty per cent on the amount of oil required for proper lubrication. This estimate does not include the recovered wool, where the optimists (that is those who think they can sell oil for wool) rule, and include in their manufactured product a large amount of unessential oil. In oiling cotton for carding it apparently is the custom to make too dilute emulsions. Very little oil is needed on cotton, in fact none is better than too much, this does not mean, however, that the oil emulsion should be made with a large quantity of water and small quantity of oil. The emulsion itself should be made in a fairly high degree of concentration and subsequently diluted. Atomizing a mixture of oil and water does not give as good a dispersion of oil as atomizing a thoroughly emulsified and then diluted mixture. Emulsions in oiling worsted for combing have not come into as extensive use as might naturally be expected because it is the custom to use oils of a high free acid content and consequent low surface tension. The low surface tension makes such oils cover a large fiber area, but such coverage is really an evidence of loss of true lubricating properties.

Quality of Oil Emulsified

Great emphasis is placed on the quality of oil required for worsted lubrication, but the subject has not been investigated with much recognition of modern physical chemical methods. In all likelihood there is not a great deal of lubrication required, and if a thoroughly emulsified oil were diluted and applied by atomization the amount of oil actually required probably would be surprisingly small. In throwing oils for silk and knitting oils for silk and rayon, one finds that either oils with a low surface tension are used or the self emulsifying type which means that an extraordinarily large amount of soap is used to carry a correspondingly small quantity of oil. It would seem that good economy should result for determining the degree of lubrication required for these fibers and then emulsifying the oil in a colloid mill and applying such an emulsion after dilution. The quantities of such oils while large in the aggregate are probably too small for the individual user, in most cases, to install a colloid mill particularly for this purpose. While abroad the marketing of emulsions has been rather more developed, it would appear that there should be a very good commercial opportunity in supplying them for the trade in this country which is more or less neglected. The question of the proper oil to emulsify or the degree of lubrication required is not entirely simple. Oftentimes a poor oil in the properly emulsified form may give a better result than a better oil not properly prepared. Undoubtedly the large proportion of soap frequently used requires a larger proportion likewise of oil to contribute the same degree of lubrication. How far it is desirable to reduce the surface tension of a lubricating oil is likewise a moot question. In textile practice, both in combing wools and silk, it has been the custom to employ oils of considerable free acidity, which as already stated, reduces the surface tension of the oil and so increases its tendency to spread on the fiber, but at the same time this lessens the lubricating properties. In place of free acidity the surface tension of oils is lessened, particularly the interfacial tension between oil and water, by the addition of substances that are freely soluble in oil and somewhat soluble in water.

Phenol and Cresols Reduce Surface Tension of Oil

Phenol and the cresols are examples of such substances, and it is an interesting inquiry if more uniform results in lubrication might not be obtained, by using a neutral oil or even a mineral oil the surface tension of which was standardized by the addition of a definite quantity of phenol. In discussing the lubricating properties of oils we are perhaps straying somewhat from our subject of textile emulsions and a return may be made by reporting of advantages observed in using emulsified tallow in place of ordinary tallow as a yarn lubricant in warp sizing. Like all emulsions a tallow emulsion is easily and efficiently made with a colloid mill, but for this sort of emulsion the paste type of colloid mill is preferable as it does not have the same tendency to beat in air. In the emulsification of fats and waxes it is the better practice to use stearic acid instead of oleic as the acid element of the emulsifying agent. As with liquid emulsions the alkali employed is not of particular moment but what preference there is, is probably for caustic soda or potash. A most satisfactory tallow emulsion is made by using fifty-five per cent of tallow, five per cent of stearic acid, and forty per cent of water containing one per cent of the total weight of caustic soda. The stearic acid is dissolved in the melted tallow and then this is thoroughly stirred into the water containing the caustic which should be of a temperature somewhat above the melting point of the tallow, say 140°-150° Fahr., and this mixture put through a paste type colloid mill. When

cooled this emulsion will appear considerably harder than the original tallow and it may in this form be directly added to the boiling size. Instead of the emulsion breaking as might be naturally expected at this temperature the tallow is evenly dispersed throughout the size and an even less quantity is required for the same degree of lubrication as of straight tallow. By the use of such emulsions many have reported a saving of fifty per cent in the tallow bill. For softening and finishing pastes the same general directions apply as in the preparation of tallow emulsions. The customary practice for such pastes has been to use a far larger percentage of stearic acid soap than is used with tallow, but it is doubtful if this high percentage of soap is necessary, in fact it probably does not contribute anything to the softening property. Merely this large amount of soap has been used because until the colloid mill was available it was difficult to prepare paste emulsions without it. In place of straight stearic acid for the fat element undoubtedly it would be economical to substitute some cocoanut oil the melting point of which was raised by a small admixture of paraffine wax. In finishing pastes, as an aside remark, it may be mentioned that the textile industry has not paid sufficient attention to deoxidants to prevent rancid odors developing in the finished goods. A trace of pure phenol is efficient as a deoxidant but where the odor of this is objected to, as being as bad as rancidity, benzyl alcohol may be substituted at not prohibitive expense. Wax emulsions are used in constantly increasing volume in the textile industry sometimes in small quantity as constituents of special finishes or for lubrication in napping and again in large quantity for shower and water proofing. The preparation of these wax emulsions is along the same general idea as that of the tallow, but in general it is better to prepare them in lower concentration. It is seldom advisable to have over a forty per cent emulsion even for paraffine wax, and for the harder waxes like carnauba or the chlorinated naphthalenes, a twenty-five per cent emulsion is more satisfactory. The more concentrated emulsions have a tendency to surface hardening or standing, and if this stage is not reached there is apt to be some powdering when they are applied. In conclusion it should be emphasized that the whole subject of making textile emulsions with colloid mills is relatively very new, but sufficient has been done to demonstrate that it is to be a fertile field for investigation.

Distribution and Its Effects Upon Production*

By **EDWARD A. FILENE**

President, William Filene's Sons Company

THERE are two ways in which we may approach the subject of Distribution. One is the way of technical and special interest, the other the way of the broadest human interest. Both ways may be scientific. If they are not scientific, in fact, all discussion is futile. But to relieve the minds of those of my audience who are not specializing in the details of merchandising, let me announce at the start that it is only the broader human aspects of Distribution and its Effect upon Production which I shall attempt to discuss today.

I do not know of a more warmly human subject. None of us try to concentrate upon it because all of us, pretty much, *have* to concentrate upon it. If you were not vitally and consciously interested in distribution, you would not be here. In fact, you wouldn't be anywhere. For distribution is the first problem which enters into everybody's life. It is the first thing a baby ever thinks about—How about the milk situation? And where do I get mine?

And we don't outgrow this interest with maturity. I have had occasion during the past few years to talk with very many grave and reverend college professors. They have been noble, high-minded men, utterly unselfish apparently, and devoted always to their ideals of the highest good. But they have been many men of many minds. They have been radical and conservative, orthodox and heretic, militarist and pacifist, wet and dry—but upon one subject I have found them enthusiastically unanimous. They all believe profoundly, with all their heart and with all their mind and with all their strength —that the salaries of college professors ought to be much larger than they are.

Now, why do college professors want larger salaries? There is only one answer. It is because they want more things.

But why do they want more things? Is it because they are materialistic? NO. It is because they are NOT materialistic. It is because they want to live above and beyond the mere struggle for existence. It is because

*Address delivered at Lehigh University October 17th, 1930.

they want to concentrate upon the achievement and distribution of knowledge and of human enlightenment, instead of having their energies dissipated in trying to stall off the landlord, or in finding the wherewithal to give their own children an adequate education.

While we are all interested in distribution, and can not help being interested, concentrating on the problem does not necessarily get us anywhere. When a man visits a fortune-teller to advise him upon what stocks to buy, the trouble isn't with his lack of concentration. It is with his lack of common sense.

I consider it a rare privilege, then, to discuss this all-important problem with such an audience and in such an atmosphere as this. I do not mean a mere atmosphere of earnestness and of scholarship. This university is known for its special emphasis upon science; and all hope for the basic, lasting prosperity and peace of the world lies in the substitution of this exact, fact-finding, scientific method of approaching human problems for the old system of consulting our feelings, our prejudices, our traditions and our taboos.

Such exact thinking is the special purpose and the result of an engineering course. An engineer, to be sure, may be a fact-finder in the matter of building bridges, and a chaser of dreams and will-o'-the-wisps in his political and social efforts; but sooner or later the discipline of fact-finding in his vocation is likely to transform him into a fact-finder in all his avocations, even in his citizenship, his family relations and his religious life.

True science, we have come to know, is not opposed to religion, to art, to idealism and humanitarian pursuits. It is opposed to muddle-headedness in all of these things: and it is the destiny, I believe, of the scientifically trained engineering minds of all America—the men and women to whom fact-finding has actually become second nature—to correct the muddle-headedness of that fearful, devil-worshipping, tradition-bound phenomenon which we call our system of distribution.

In our present economic system, we have machines for production which we call factories, and machines for distribution which we call stores.

Let anything go wrong with production in the factories, and those in charge generally want to know all about it at once. But *modern* producers go much farther than that. They do not wait for things to go wrong. If things stay as they are in their factories, they want to know all about that; for in any really modern factory, not going ahead is equivalent to going back.

For successful production nowadays is scientific; and science is the process by which we are coming into more and more knowledge every day. By applying this new knowledge in production, we get better and better results; and if we do *not* apply this new knowledge, some bright competitors will apply it, and *they* will get better and better results, automatically eliminating us and our stick-in-the-mud outfit from the field of production entirely.

Now, all this applies to the problem of distribution quite as much as it does to production. The main difference between the two processes is that leaders of production are generally awake and not only understand but act upon the principle, while distributors are still very much asleep and do not realize they are living in an age of science, in which scientific principles must be applied. This would be all very well, and competition could be depended upon to eliminate the unfit distributors in time, if we were not *all* meanwhile too much involved. In such a situation, as in an epidemic of typhoid or smallpox, we cannot afford to let nature take her course. We must do something about it. What we do may not be intelligent, and it may make the situation even worse than it was before; but when, in any human society, the system of distribution breaks down, that society breaks down. Babies may only kick and cry when the milk fails to arrive. But that is only because they are so weak and ignorant; if they knew how, and were strong enough, they would resort to murder and pillage. And no matter how civilized a people may be, if they are made desperate by hunger, particularly by the hunger of those whom they love more than they love themselves, they will stop at nothing which promises to relieve that situation.

Distribution is the all-inclusive and all-important problem for everybody. Distribution, in fact, takes precedence over production; for if there is enough to distribute and it is being distributed, the question of whether the factories are going or not becomes rather academic. Who cares whether the factories are open or shut, excepting that their being closed makes distribution impossible? This is so self-evident that it sounds almost silly to call attention to it. It is equally axiomatic, however, but unfortunately it is necessary to call attention to it, that any breakdown of the means of distribution makes production too difficult or impossible.

Production and distribution, in fact, are not two processes. They are simply aspects of the same process—the process which we call industry. It is like the process of breathing. You will never see a man who is able to *breathe in* all right but can't *breathe out,* nor one who can breathe *out* as usual but can't breathe *in*. The trouble with the man in either case is that he can't breathe, and that is a rather serious predicament.

Unfortunately, because work is something which human beings have had to learn, while the ability to eat seems to come naturally to them, human society has built up a considerable philosophy of work *per se,* as though it could be separated from its associated process of getting and having and enjoying the things for which we work.

Work happens to be necessary to human happiness and it happens to be a great and good discipline. But men and women do not work in factories just for the joy of working, nor because of any great moral compulsion. If the factories are well-managed, they may get much joy in them; and the work, in fact, may become so fascinating that they may be permitted to forget that all this work is necessary and go to it with the feeling that it is really fun. But if the factory is not producing things that people

want, it simply isn't a factory. It is the desire for things that motivates production, not that wonderful creative impulse which we hear so much about. We first want something; then we try to create it. We don't feel the urge to create something and then learn to like it.

Our primary longing is to keep alive; and since keeping alive requires food, shelter and clothing, we learn to hustle for them. Only when our primary longings are attended to, do we ever get around to yearn for higher things.

Man wants water, and if he cannot reach it easily, he yearns for something with which he can scoop it up. So he invents and makes a cup. And after he has learned to make cups, and finds them useful, he tries to make more beautiful cups and thus develops the whole art of pottery. The original motivation, however, is thirst, and the desire for something to carry water in. We haven't yet developed anything beautiful to carry air around in, for the simple reason that the air is pretty well distributed already. We have no urge, so far as I have been able to find out, to create anything of the sort. To be sure, we have a great and marvelous creative impulse, but the impulse always seems to be to create something which somebody wants.

There, fundamentally, is the relation of distribution to production. If there is no demand for a particular article, some crazy person may conceivably go on producing it; but there is no danger whatever of any modern factory devoting its time and money for any protracted period to such an undertaking.

But there must be something more than a demand. In China, they are growing so much rice that they are able to export large quantities to America and other countries, and the growers have kept out enough to supply themselves, And yet, in China, millions of men, women and children have recently died of starvation because they could not get any of this rice.

Why? Was it because the Chinese government, or the Chinese farmers in the productive districts, did not care anything about the millions who were stricken by famine? No. There are no finer nor more philanthropic people on earth than the Chinese, but they were up against a fact. The fact was that there were no adequate means of distribution. There were no roads into this remote famine district. America, with all her wealth and all her willingness to save these sufferers, was as helpless as the Chinese themselves. The only way that rice could be carried to these starving folks was upon the backs of coolies; and before a coolie could reach the center of the famine district, he would have eaten up all the rice which he could possibly carry, and become a victim of the famine himself.

One may suppose that nothing of the sort could possibly happen in America. But something of the sort *is* happening in America. Fortunately, it is not so terrible a situation. There are no millions here who are actually starving. But there are millions who are suffering—suffering for the lack of things which we have been producing abundantly, and of which we have piled up such a surplus that we would gladly export it to other countries if we could. But the reason we do not export it to other countries, or even distribute it to our fellow-countrymen who want it so desparately, is that we have no system of distribution commensurate with our system of production, and the goods which can be so economically produced, are so clumsily and so wastefully distributed that the cost of the whole process—the process of production plus distribution—become prohibitive; and so far as the would-be consumer is concerned, the goods may as well have eaten themselves up in transit.

When we buy a Ford or a Chevrolet car, to be sure, we are getting it pretty close to the cost of production. But suppose it cost $400 to make one of these cars and $1,000 to distribute it. What would we do then? Not many of us, surely, would or could buy that Ford or Chevrolet. And with so few of us buying Fords and Chevrolets, Ford and Chevrolet would have to cut down production to a tenth, say, of their customary output, and the actual cost of producing the car, with such a small output and such a large overhead, instead of being $400, would very likely mount to $800 or $1,000. Now $1,000 plus $1,000 is $2,000, which might be a very fair price for a very silly method of production and distribution, only there wouldn't be much production and distribution, and there wouldn't be many automobiles of any kind. Even the higher-priced cars would then be relatively undesirable; for what makes them desirable are the motor highways which came into existence because of the mass production and mass distribution of automobiles.

Do we realize, I wonder, when we go into the average retail store, that we are likely to be engaging in a transaction equivalent to paying $2,000 for Fords? Not that the grasping retailer is getting rich at our expense. He is much more likely to be going broke because, while it has become so easy to make things, distributing them is still so hard. The trouble is that he is part of a very unscientific system of distribution; and this distribution not only costs two, three or four times as much as scientific production but, through making mass production impossible, is likely to double or treble the cost of production itself.

It is worth noticing that, when Ford and Chevrolet developed their mass-production system, they did not go in to produce cars for "the trade." They did not go to automobile wholesalers for estimates on what kinds of cars would be likely to please the whims of all sorts of people during the coming season, and the wholesalers did not show a thousand models to the retailers, leaving the retailers to guess what particular flare in wheelbases, motors, gears and ignition systems would be most likely to catch the fancy of their discriminating customers, and then to buy as large a variety of cars as they possibly could, tying up all their capital in the process with the almost certain result that, with the coming of the newer styles, a large part of the stock would still be on their hands.

If Ford and Chevrolet had done this, it might have pleased a certain type of individualist. If everybody is to have a car, he might say, by all means let everybody have a different type of car, and let us be delivered from deadly uniformity.

But with such a system of distribution, everybody would not have a car. Cars would cost so much, in fact, that only a small class of the very rich could afford to have them, and almost all of us would be going without them—with deadly uniformity. All America is a-wheel to-day, and Americans are going places and seeing things, and participating in the boundless variety of modern life, because Ford and Chevrolet found out what the masses really wanted and presented it to them at prices which the masses found it possible to pay.

In making our average purchases, however, we customarily go to little shops which must meet their total expenses out of the few sales which they are able to make, and who are in no position to buy these things at a reasonable price to start with.

This system, we may think, gives us variety; and in a way, it does. It gives us such a variety of things in which we have no possible use for variety that we cannot afford to be distinctive in the things which really count.

If we need a monkey-wrench at home, is it spiritually necessary that we shall have three or four hundred styles to choose from? If we get the size we need, and it's a good wrench, does it not just about fill the bill? Will not one design satisfy our personality about as well as another? Well, if it won't, the situation is truly rather dark. For, if every monkey-wrench had to be distinctive, they would be so costly that few of us could afford to have one, or else America would be using up so much of her time and energy manufacturing and distributing individual monkey-wrenches that Americans would be deprived generally of a lot of other things.

There is a good sound historical reason why we have so much variety in things where variety is not only unnecessary but unwanted, just as there is a reason why we still have buttons on our coat-sleeves.

You know what those buttons are there for, don't you? A lot of people have worked a lot of time, all told, making all the buttons which American men are wearing on their coat-sleeves to-day, and it was another considerable job to make the thread and sew them on. But why are they there? Not for looks. Not for beauty—look at the ones you are wearing and tell me honestly whether you consider them beautiful. They are there simply and solely because the knights in the middle ages used to wear lace fol-de-rols hanging down over their hands, and they had to find a way to fasten them back when they came to the table so that they would not dangle in the gravy.

We have long done away with the fol-de-rols, but we've kept the buttons as a symbol of our nobility. But not a particularly useful symbol. I doubt if we can always tell whether a man is a real gentleman or not, by looking at his coat-sleeves to see whether they have buttons on them.

Now, there is just about as sound a reason for having a variety in most of the lines where we customarily have a wide variety. Not so long ago, almost all Americans lived either in small towns or in the farming sections of which those small towns were the commercial centers. People in those days seldom left their own communities, and they were dependent for most of the things which they ate and wore and used in other ways, upon their local industries. The local blacksmith, for instance, made most of the tools; and when the railroads were built and modern means of communication began to change things generally, the best of these blacksmith shops began to evolve into machine shops. Their products, of course, had individuality, and they were different from the products of every other shop; but when modern power, modern communication, and modern science made it possible for single industries to give nation-wide service, there was no further reason for several hundred different varieties of everything. All logic, in fact, was against it, and standardization was developed. But tradition still clung to the old buttons, although the reason for buttons had passed away.

Standardization, as far as it has been developed, has not tended to standardize life. It is in our tradition that life is standardized—in our fear of facing the facts—and in so far as we do face the facts and act fearlessly upon them, human lives are liberated to go their different ways. Fords have not standardized us; they have made it possible, for one thing, for modern youth to ignore all the standards which have been set up for generations. To get away, for instance, from chaperones, with their set standards of conduct, and so far away that it is doubtful if the young people in this audience have any very clear idea as to just what a chaperon was.

We are living in a new world to-day, but we are not doing it so very successfully as yet. For our traditions everywhere are clashing with our knowledge. In so far as we yield to science, we make amazing progress, but in so far as we think traditionally, we find that progress disappointing.

Just now, for instance, in this great new era of mass-production when the way has been found to supply all our material wants so abundantly, and when in all conscience man should find himself liberated to pursue the highest ideals of human life, we find the world prostrated with unemployment, unable to use this magic mechanism which we have invented and millions and millions of us the world over hungry and desperate because it is not being used.

And it is not being used for just one reason. That is, because, while production has been following the dictates of science, distribution is still trying to remain traditional.

Under the old economic system, when business and industry were largely local matters, every American hoped to become independent. Not many did, but there

was always the hope. If a man were willing to apply himself to the task, and he were blessed with unusual ability and unusual luck, he could quit working for someone else and build up a successful business of his own. Ninety per cent of those who set up independent businesses failed within a very short time; but if everybody were sufficiently honest, industrious and thrifty, it may have been presumed, everybody could eventually have a business of his own and nobody would have to work for anybody else. At any rate, independence was the watchword.

And true enough, if one did have to work for someone else, he was out of luck. For labor was a commodity. Employers bought it, of necessity they supposed in the lowest market they could find. They paid what they had to pay, and people who were hungry were willing to offer their labor for very little in the way of wages or buying-power.

Then came the era of scientific production. The era of fact-finding, as opposed to running things on mere opinion, one's opinion generally being the result of his traditions and prejudices, not of anything which he had actually discovered to be so.

It was soon discovered that making things in large quantities was more economical than making them in the old-fashioned way, and big trusts hoped to put all the little fellows out of business and, by charging monopoly prices, make all the money in the world.

But that was not scientific mass production. There was something wrong with the formula. Henry Ford, by fact-finding methods, corrected it. He, more than anyone else, is responsible for the revolutionary discovery that you cannot sell very much to a man who has no buying-power and that, if you hope to sell things to the masses, you must set a price which the masses will be able to pay.

From that time on, things hummed. One tradition after another fell down and presently we were in a new world. I mean, with one foot. We haven't got the other one out of the old world yet, and we are somewhat dizzy, for science and tradition do not mix very well.

But a lot of things were discovered. It was discovered, for instance, that everybody could not have a business of his own but that, if there is to be any business worth while, we must all be working for everybody. That is the real meaning of mass production, production for the masses; but it raises hob with our old notions of independence. It makes us all interdependent, instead.

But all, under this newly discovered formula, must not only work for everybody, but must be adequately paid for it, else they will not have the buying power which will be required if the greatly increased total product is to be sold. So mass production went in for high wages—wages in some degree commensurate with the new productivity—and for shorter hours so that the masses of potential customers might have leisure to use automobiles and things and therefore an incentive for buying them.

Having discovered a way to get our work done so easily, it might be supposed that we would slip smoothly into the new system and enjoy its benefits. But every scientist knows better. He knows that every great and liberating truth which has been discovered has gone whack up against some sacred tradition, and that these traditions fight hard to hold their human slaves in bondage. One cannot discover anything, even in biology or geology, without running the risk of being damned for it, and when industrial science discovered that everybody cannot be independent of everybody else, tradition asserted itself violently.

We even have movements to tax the chain stores out of existence—the chain stores, the first attempt on the part of retailing to achieve mass distribution in harmony with the development of mass production. At the very time when about all that the world needs is a scientific, economical system of distribution so that mass production shall be able to function, distribution generally is not only refusing to take the step, but frantic efforts are being made, in the name of all the old holy traditions, to mobilize public sentiment against the move.

The chain stores, of course, are but a halting first step. Ultimately we must come to mass-distribution upon a scale which we have scarcely dreamed of yet. And all along the line, from production of raw materials to the purchase of the finished product over the retail counter, there must be such an elimination of waste that the masses everywhere shall be able to buy in abundance in proportion as science teaches us how to produce abundantly.

This itself would eliminate unemployment. The cure for unemployment is through the lessening of work, not through any system which makes unnecessary work necessary. It is through economy, not waste, throughout the whole process of production and distribution. For with such economy, prices *can* be lowered; and with a scientific outlook behind such economies, an outlook without which the very discovery of the economies would be impossible, prices *will* be lowered, and with the lowering of prices, more people will be able to buy more things, which will necessitate more production and more employment.

The consumer, we now know, is the ultimate employer. If the consumer has little purchasing power, he cannot furnish much employment, and the unemployment which inevitably results will still further curtail buying power and create still more unemployment. Every waste in production or distribution tends to limit sales and therefore to depress all industry.

Eventually, I have said, there can be but one solution—a solution in which everybody is bound to win. But we cannot afford to be too optimistic. For tradition is still in the saddle; and unless tradition gives way to fact-finding very soon, the results may easily be so terrible as to render it impossible for a long, long time, to act upon the facts in our possession.

Industry, for one thing, cannot be successful unless there is stable government; and the breakdown of distribution, particularly in Europe, or the failure, rather,

of distribution to keep pace with production, is already producing conditions which threaten all the European governments.

I have just returned from four months' study in Europe. I make it a practice to spend at least a fourth of my time each year outside America, for with business having become not merely national but international in character, and dependent as it is upon what is happening everywhere, I find it highly advantageous to keep in as close touch as I can with world events.

This summer, I spent considerable time in Germany, and the conditions are particularly alarming there. Conditions are bad because the people have so little buying-power. Unemployment is already staggering, and this unemployment is producing more unemployment. Conditions are so bad, in fact, that if the government were to undertake a thorough program of correction, the people might not be willing to wait until its benefits could be realized, and only rough first-aid measures now seem possible. As the most practical first-aid measure, I have been urging a cut in prices. The wage scale should of course be raised, but desperate employers cannot see their way to do that. However, if they cut prices in two, they would be doubling the size of the consumer's dollar, which amounts to a doubling of everybody's wages, which would mean a doubling of purchases and such a stimulation of industry as might result in employment becoming general again.

There is a growing realization in Europe, I am glad to say, of the economic character of all their political disturbances. The alarming swing to the extremist parties in the recent election in Germany, it is pretty well understood, is not due to any widespread real belief either in Fascism or Communism, and certainly cannot be due to any demonstration of successful practice either in Russia or in Italy. It was due solely to unemployment and to desperation.

We often speak as though we feared the success of Bolshevism or of some other dictatorship. It is their inevitable failure, rather, which worries me most. They are doomed to failure. Economic problems cannot be solved by either Nationalistic or class traditions backed up by military force. And with the inevitable collapse and chaos, or a repetition of the age-old ruse of governments, when they confront an angry and revolutionary populace and attempt to save their own position by declaring war and turning this hatred and belligerency against some trumped-up foreign enemy.

Mere political chicanery and political force cannot correct the ills of industry. Only scientific fact-finding can do that. That is why the peace of the world, as well as world progress and world prosperity, depends upon the engineer. In my conference with German leaders, especially in my talks with business men, I put it this way: "We know very well that all the necessities and comforts needed for a satisfying life in Germany cannot be bought for ten pfennig. But suppose that they could be, what would happen? Everybody in Germany has or can get ten pfennig, therefore, everybody would purchase, not only all the necessities but all the ordinary comforts of life. That is, of course, if there was man-power enough in Germany to produce all these things. But with all your unemployment, there isn't that much man-power available. Your millions of unemployed would all find jobs at once, and there would be a frantic search for more millions to supply this all unheard-of market.

"Now," I said, "all these things, I know, cannot be produced and distributed for ten pfennig each. But at present prices, there isn't a sufficient market to keep your factories going. Somewhere between ten pfennig and the present prices, then, lies the price that would keep your factories going with the utmost possible benefits to everybody concerned, employer, employee and consuming public." Prices, it was evident, could not be lowered through cutting wages, for every cut in wages makes buying more unlikely. But they could be cut through eliminating waste and I had only to point to America where, although the price level was about the same as that in Germany, wages were three times as high.

I did not know, I told them, what that *prosperity-price* might be, and my opinion, I said, would be of no use to them. It is not a matter of opinion at all. It was a plain case for fact-finding. It was a job for the engineering mind.

When engineering is applied to distribution, distributors will not engage in a frantic scramble for the consumer's dollar, without any exact information as to how much the consumer's dollar can buy. It is known that sixty-five per cent of the average consumer's dollar is pretty well staked off already for food and rent, and that only thirty-five per cent remains available for education, recreation, medication and the things to which we point when speaking of prosperity.

That may be a helpful bit of information, but it isn't very enlightening at that; for until we know how large a dollar is, we can hardly know what thirty-five per cent of a dollar comes to. But we do know this: The consumer's dollar is large if it can buy a lot of things, and it is small if it can't buy much. And whether it can buy a lot of things or not depends upon how much waste there is in the process of production and distribution. Waste in production will necessitate high prices, curtail the consumer's dollar and make distribution difficult. But waste in distribution will likewise curtail production, creat unemployment which will make the consumer's dollar shrink rapidly toward the vanishing point and compel the production which is continued to revert to less scientific methods than mass production. In a word, scientific distribution not only supplements scientific mass production but compels it.

I have written a book which is just off the press in which I have tried to outline the steps that must be taken if merchandising is to keep pace with manufacturing. This book deals with the technical side of this question and is primarily meant for merchants and salesmen and

buyers, and for manufacturers and bankers and executives who have merchandising problems to solve. But it was not the technical details, I am sure, which you wished to hear about today, and I have tried rather to point to the basic principles upon which distribution must be organized if it is to be most helpful to production.

What we need is the engineering approach—the approach of the fact-finder, who learns to have more respect for one demonstrated fact than for all the opinions on earth, including his own. We must know the truth, for only the truth can make us free. We must erect this structure of distribution as an engineer erects a great skyscraper, not because buildings used to be erected thus and so, but with full knowledge of all the stresses and strains to which this structure may be subjected and with materials scientifically calculated to meet those strains.

As yet, there is little comprehension in the world of merchandising as to what the structure of merchandising is for. Until there is such an understanding, until the public perhaps forces such an understanding upon would-be distributors, we can hardly look for stabilized prosperity. The purpose of a store, they must learn, is not to keep storekeepers going, any more than the purpose of houses is to collect rent. This, however, will not require any change in their human nature, nor that they shall lose their taste for profits. It requires only a little engineering research, the perception of profits as a reward for service and the discovery that maximum profits can come only from maximum service.

It is not a difficult lesson, but tradition is old and science is new, and to pursue the path of fact-finding consistently is a pretty large order for all of us. None of us is independent, even in our thinking, and there is such a discrepancy between the actual facts and the way in which we have customarily looked at things, that we are constantly undoing with traditional hands the things which our scientific hands are finding to do.

We are erecting tariff barriers throughout the world, for instance, to make mass distribution impossible at the very time when it is most necessary. We are lowering wages in many cases when we ought to be raising them and increasing the buying power which alone can bring prosperity. And we, in our literature and drama and even in our pulpits are crying out against the "materialism" of this machine age, when what is most needed is to perceive the machine for what it really is—the instrument which man under science is at last raising up to solve the overstrain of the struggle for existence and liberate him to pursue his cultural and spiritual aspirations.

General Dyestuff Corporation has sent out circulars illustrating Cellitazol AZ Paste, a new Diazo dyestuff for acetate silk which is said to give, with Developer ON, full bloomy blacks dischargeable with the aid of Decroline Soluble Conc. The company claims that this product marks a real innovation, in so far as it was heretofore not possible to get a dischargeable black so easily.

Process-Marking Carried Through to Ultimate Consumers

By WALDON FAWCETT

SO MUCH stress has been placed on one phase, or objective, of the "Quality-Control" plan that there is danger that another and no less significant consequence will be overlooked. The cultivation of consumer confidence—confidence, say, in color dependability—is admittedly important in the rayon industry, as it is in other sections of the textile field. Even so, it is a question whether the guaranty-labeling function of the system which has lately come into favor is more important than the advance which this fresh modification has made possible in the technique of textile identification.

No need to remind readers of the REPORTER of how prolonged and baffling has been the problem of providing textile-marks which can be depended upon to carry through to ultimate consumers. Few complications are incurred in the identification to the trade of quantity units. But, largely by reason of the character of the product, ingenuity has been taxed to find trade mark mediums that will endure to the ultimate destination of the finished product and will appear on the smallest marketable sub-unit sold at retail. If difficulties have confronted the major-marks of marketing principals, how much more serious the plight of the process-marks of the intermediaries in production?

A new hope for the future of process-marking in the textile field has risen with the appearance of the identification label which is not destroyed or obliterated until the last quarter yard of each marked piece of fabric has been sold. Better yet, the new device the more surely arrests the attention of the casual customer by combining the functions of a brand and a seal. By sealing the end of a piece of goods to the end of the tube on which the fabric is rolled there is provided an "assurance of genuine origin" which is continuously visible to successive customers at retail through the simple expedient of exposing the sealed-to-the-core end by folding over the edge of the tube where it remains in plain sight.

Gain there is for the industries at large in the evolution of any form of textile marking that will brave the vicissitudes of conversion and distribution. An added boon has been brought by this current development in the form of a practicable combination identification mark. This strikes at the very root of the need of the hour in process-marking, viz., a joint indicia which will give clue to the identity of the primary producer of the transforming interests which refine the commodity into marketable form, and, if need be, of the ultimate marketer. Under this plan, source-marking (for instance, the identification of yarn) and dye-marking or other process-marking, become, in effect, steps in hallmarking and form a permanent, always-visible background for whatever labeling may be undertaken by the seller at wholesale or retail.

Process-marking to ultimate consumers of textiles has suffered in the past not alone from the obvious physical difficulties of providing co-operators' marks that will carry through to ultimate consumers yet not mar the appearance of the most delicate fabric. On top of that has been the danger that a process-mark or enviable reputation be brought into disrepute through improper use of the marked material or misrepresentation regarding it. Risks of this character are reduced if not eliminated by the contract-agreement system which may embrace yarn producers, dyers, knitters, weavers, etc., and manufacturers of finished textile products. Check upon the operation of the license system may be maintained at all times by a code system whereby inspectors may, upon consultation of labeled apparel, determine instantly who made or processed the fabric and who made the garment.

The new arrangements for carrying through to ultimate consumers, the source-marks and process-marks on textiles and for cultivating the consciousness of the public with respect to this class of marks must likewise operate to gain full recognition, under the Federal trade mark system, for this class of symbols of authenticity. Whereas the United States Government has, for some half a dozen years past, recognized, under favorable circumstances, the right of registration for dyers' marks, converters' marks, finishers' marks and equivalent process-marks, this right is not yet so deeply nor so broadly grounded but what additional confirmation is welcome. Particularly if Congress is to delay the pending revision and liberalization of the trade mark statutes.

When the Federal censors let down the bars to process-marks by the precedent established in the test case of the Bradford Dyers' Association the principle was established that a process-mark is eligible to registration only if and when it can be shown that the identified process adds to the value or salability of the merchandise treated. In that respect process-marks have been placed on the same plane as original ornamental designs which are required to make a showing of enhancement of salable value in order to command a design patent at the U. S. Patent Office.

Thankful for so much of a concession after years of official discrimination against process-marks, dyers and other processers have, nevertheless, never ceased to covet a right of registrability which would be based, not upon the addition of tangible value to a processed fabric but rather upon a sentimental enhancement accruing as a result of expert, discriminating selection by the processer of the material to be processed. In other words, dyers have contended that they earn their process marks not alone by the character of the dyeing and the quality of the dyes employed, but no less by the responsibility which they assume (and proclaim) for the selection of suitable materials for dyeing. If this latter principle has never been as fully recognized at the Department of Commerce, as some dyers might desire, there is no question but what the theory must gain in dignity by the new version of "quality control" which emphasizes the selective, censorial element.

The version of "quality control" which is just now being exploited most energetically has an especial slant of interest in that it reveals process-marking-to-ultimate-consumers as a valuable consideration in the negotiation of license agreements and grants of exclusive agencies of exclusive connections. In years gone by, it has been assumed that dyers and other processers desired to gain currency for their process-marks merely as a means of establishing good will in business independent of the good will created by the product in its finished or marketable state. Now, thanks to the new twist, process marking stands revealed as a lever to persuade apparel manufacturers and other fabricators to enter into license agreements. And, in its train, the licensing system is bringing what might be termed the "combination process label" meaning a composite process-mark which bespeaks the joint responsibility of two or more processers or of a processer and a primary producer. Just in proportion as the license relationships are played up to the public, in advertising or otherwise, is there inherited the problem of keeping the consuming public informed as to the existence and (on occasion) the termination of agreements covering the use, by proxy, of controlled marks.

Recording Color Analyzer Is Placed on Market

THE General Electric recording color analyzer, announced some time ago as a laboratory development, has now been placed on the market. The device has been made much more compact and sturdy than the laboratory instrument, without loss of speed or accuracy.

The analyzer, a photoelectric device, automatically draws for permanent record the color curve of a sample in the visible spectrum. It is so constructed that either solid substances or transparent materials can be analyzed. It is a laboratory instrument, best used for the accurate control of the basic materials entering into the manufacture of colored products.

Light from a vertical, tungsten-ribbon filament passes into the slit of a dispersive system. Emerging from this system through another slit as monochromatic light, it is passed into a collimator. Here it is divided; half is taken off with a right prism and brought to a focus at a sample stand, and half passes through a shutter and is brought to focus on a flicker disc, which has on its surface a standard white pigment. Light from the sample is collected and brought to a focus in the plane of the flicker disc and is passed into a photoelectric tube.

As the flicker disc is revolved, the photoelectric tube views alternately the standard and sample at a rate of 60 alternations per second. A greater amount of light reflected from the standard than from the sample results in a pulsating photoelectric current which is amplified electrically and used to control a motor-operated shutter

in the standard light path. This shutter will operate until the beams are of equal intensities. The balance point is indicated by the recorder.

As the record drum revolves, the wave length of the light passing through the exit slit of the monochromator is varied at a uniform rate from 400 to 700 millimicrons, and the curve obtained indicates at each wave length the

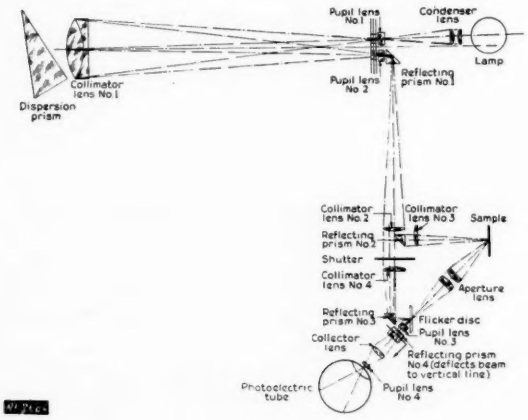

Fig. 1
Lens System of Color Analyzer

position of the shutter which allows an amount of light to be reflected from the standard equal to that being reflected from the specimen. The shutter is so constructed that the opening is directly proportional to the amount of light passing through.

Approximately 3½ minutes are required to obtain a characteristic curve—the period from the time when the pen starts drawing the curve until it is raised after completing the curve.

The power source for the analyzer includes 110-volt, 60-cycle alternating current to supply the power transformer and the flicker motor, and eight-volt direct current for the lamp and filament currents. It is recommended that an eight-volt, 210-ampere-hour storage battery be used.

Since the anlyzer is a recording instrument, it does not require the services of an operator with specialized training in optics. As it uses a photoelectric tube, it has ample sensitivity at the violet end of the spectrum, where visual spectro-photometers must always fail because of the low visibility of violet light.

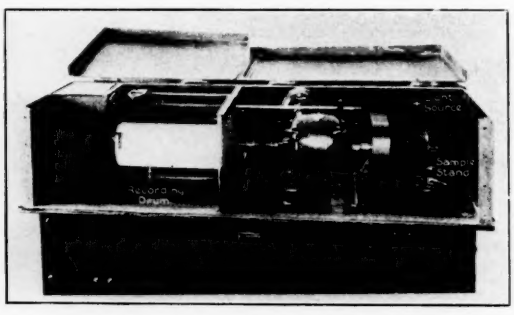

Fig. 2
Recording Color Analyzer View with Front Plate Removed

The importance of the recording color analyzer lies in its value to industry, in nearly every branch of which control of the color of products is necessary. Accurate measurement of colors is the first concern of manufacturers of fabrics, particularly in the delicate shades which often deceive the eye. Color control is also of basic importance in the making of inks, paints, dyes and paper. In fact, there is scarcely an industry without a color problem.

One of the most important fields of usefulness for the recording color analyzer is in cataloging of the curves of different dyes, so that new colors with predetermined characteristics can be obtained at any time by the proper mixture of standard dyes already at hand.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF AMERICAN DYESTUFF REPORTER, published bi-weekly at New York, N. Y., for October 1, 1930.

State of New York, County of New York, s.s.:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared William Howes Collins, who, having been duly sworn according to law, deposes and says that he is the business manager of the AMERICAN DYESTUFF REPORTER, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Name of—— Post office address——

Publisher—Alfred P. Howes, 440 4th Ave., New York, N. Y.
Editor—Louis A. Olney, Lowell, Mass.
Managing Editor—Bliss M. Jones, 440 4th Ave., New York, N. Y.
Business Manager—William Howes Collins, 440 4th Ave., New York, N. Y.

2. That the owner is: (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Owner: Howes Publishing Company, Inc., 440 4th Ave., New York, N. Y.
Stockholders:

Alfred P. Howes, 440 4th Ave., New York, N. Y.
Mary K. Howes, Rutherford, N. J.
Cecile R. Howes, Rutherford, N. J.
James T. Howes, Rutherford, N. J.
Derfla C. Howes, Rutherford, N. J.
N. H. Hiller, Carbondale, Pa.
Louis A. Olney, Lowell, Mass.
William F. Collins, Upper Montclair, N. J.
Derfla H. Collins, Upper Montclair, N. J.
William H. Collins, Upper Montclair, N. J.
Jos. L. Schroeder, Hartsdale, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholders or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..... (This information is required from daily publications only.)

WILLIAM HOWES COLLINS, Business Manager

Sworn to and subscribed before me this 29th day of September, 1930.

(SEAL) CAROLINE ESSENBREIS

(My commission expires March 30, 1931.)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

President
E. H. KILLHEFFER
Newport Chemical Works, Passaic, N. J.
Vice-Presidents
WALTER S. WILLIAMS—P. J. WOOD
Treasurer
HARRY R. DAVIES
Secretary
ALEX MORRISON
American Woolen Co., Andover, Mass.
Councilors
RALPH F. CULVER — GEORGE A. MORAN
B. F. PHETTEPLACE — HUGH CHRISTISON
WILLIAM R. MOORHOUSE — WALTER M. SCOTT
Past President and Chairman of the Research Committee
LOUIS A. OLNEY
Lowell Textile Institute, Lowell, Mass.

LOCAL SECTIONS AND THEIR OFFICERS

Northern New England Section—
Henry D. Grimes, Chairman, Wood Worsted Mills, Lawrence, Mass.
Harold C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Rhode Island Section—
Richard B. Earle, Chairman, 133 Power St., Providence, R. I.
A. Newton Graves, Secretary, Franklin Process Co., Providence, R. I.

New York Section—
Robert H. Gaede, Chairman, Gaede Silk Dyeing Co., Paterson, N. J.
Clemens F. Hoppe, Secretary, Oriental Silk Printing Co., Haledon, N. J.

Philadelphia Section—
A. M. Burt, Chairman, 1046 Public Ledger Building, Philadelphia, Pa.
Percival Theel, Secretary, Philadelphia Textile School, Philadelphia, Pa.

Piedmont Section—
Samuel L. Hayes, Hartsville Print & Dye Works, Hartsville, S. C.
Arthur R. Thompson, Jr., Secretary, 1109 Independence Building, Charlotte, N. C.

South-Central Section—
R. S. Wheeler, Chairman, Crystal Springs Bleachery, Chickamauga, Georgia.
J. D. Mosheim, Secretary, Crystal Springs Bleachery, Chickamauga, Ga.

Midwest Section—
Carl E. Bick, Chairman, Real Silk Hosiery Mills, Indianapolis, Ind.
William Bergh, Jr., Secretary, Vassar Swiss Underwear Co., Chicago, Ill.

Lowell Textile Junior Section—
Earle R. McLean, Chairman; Alfred J. Carbone, Secretary.

North Carolina State College Junior Section—
R. A. Gilliam, Chairman, E. B. Hardin, Secretary.

Sulfur Color Dyeing*

By E. P. DAVIDSON

THE sulfur dyestuffs, since their introduction to the trade, have come to occupy an important place among the classes of dyestuff in use for cotton fabrics. There will no doubt always be a demand for large quantities of colored goods possessed of a good degree of fastness at not too excessive cost. The dyestuffs that I am discussing tonight are almost ideally suited for such purposes, and their application presents an interesting, if sometimes exasperating, problem to the dyer.

At first glance it would appear that no especial difficulty should be experienced in their use, as they can all be dissolved in sodium sulfide and soda ash in about the same manner, and dyed with the addition of common salt, at more or less similar temperatures on cotton in any form. This procedure has been in general use for about twenty years and is well known. Sometimes, however, the dyeing goes unexpectedly wrong and it is difficult to determine where the trouble lies and what should be done to correct it.

A great deal remains to be known about the sulfur colors, both individually and as a class. Up to the present their exact chemical constitution has not been definitely determined. As far as we know they are a mixture of chemical compounds, and we are not sure that the mixture for any given dyestuff is constant, as no method of analysis is available. It follows that less is known of the reactions taking place in a sulfur color dyebath than is known of the other common groups of dyestuffs. The chemical constitution of vat colors, for instance, is definitely known, and with these colors and with most of the other classes we can predict, after a fashion, what will happen from a chemical standpoint in any given situation; with the sulfur dyestuffs we have no such starting point, and what we do know has been evolved from empirical study of the dyebath. In most other classes of dyestuff, a result obtained in the laboratory can be duplicated in the plant without a great deal of difficulty; with the sulfur colors there is a much wider divergence between laboratory and plant results. It has, for instance, even in routine shade matching, been so far found difficult, if not impossible, to make a laboratory match of a sulfur known containing Bordeaux as components that will produce a reasonably close approximation in plant application. Generally the mill dye-

*Presented before a meeting of the Piedmont Section, October 18th, 1930.

ing requires an additional 5 to 10 per cent of the Bordeaux component, indicating, of course, that better exhaustion is obtainable in the laboratory than in the plant, due possibly to the difficulty in duplicating temperature conditions. This difficulty has been given much attention and, while laboratory matches in the sulfur group cannot be expected to check as closely as do, for instance, direct color matches, nevertheless it is possible to control them at present so that great discrepancies do not arise. The fact remains, however, that the sulfur colors are decidedly sensitive to variations in temperature, volume and duration of dyeing.

With a little practice the identification of sulfur dyestuffs on the fiber is not particularly difficult. A dyer working with them a great deal can almost recognize them by their general appearance, but a simple scheme of identification can be carried out as follows:

Treat the sample under examination with a hot solution of sodium hydrosulfite. If it is stripped, it is not a sulfur color. If the dyestuff reduces, it can usually be determined from the color of the reduction whether it is a sulfur color or one of the vat series, the sulfur colors giving, as a sule, a dirty yellowish-brown vat. If on treatment with a warm solution of sodium perborate the sample returns to its original shade, it is likely to be either a vat or a sulfur color; if it is not possible to definitely determine to which class it belongs by observation of the vat, the difficulty can generally be resolved by treating the sample with a weak solution of bleaching powder, the vat and thioindigoid dyestuffs being little affected by this treatment while the sulfur colors will bleach out very rapidly.

This method is quick and practical and, in the hands of a person accustomed to use it, quite accurate. In case of doubt, however, a qualitative test for the presence of sulfur, always present in a sulfur color dyeing, may be made as follows:

Place a small piece of the material to be tested in a test tube and cover with a reducing solution. Hold a piece of filter paper saturated with lead acetate solution over the opening of the test tube and heat the latter until the solution boils. If the dyeing has been produced with sulfur dyestuffs, the filter paper will become coated with a blackish-brown film of lead sulfide.

In the dyeing of sulfur colors, as in all dyeing, the preparation of the goods plays an important part. The natural impurities of the cotton must be removed in so far as possible and the goods put into condition to absorb the dyestuff readily. In raw stock dyeing this can be sufficiently done in many cases by a preliminary boil with plain water, but this, as a rule, runs the temperature above the starting point of the dyestuff, with the consequent necessity of cooling again, and it is often better to use a wetting agent. Some of these wetting agents are more efficient at low temperatures, i.e., from 80 to 120° F., than they are at boiling temperatures and, as all types are an aid rather than a hindrance in the dyebath, the dyestuff can be added to the wetting-out bath, thus saving a considerable amount of time and steam. With dirty cotton, however, and where it is desirable to obtain as clean and brilliant a dyeing as possible, the cotton should be boiled out for about half an hour with soda ash and sulfonated castor oil, making a fresh bath for the dyestuff.

Yarn should also either be boiled out as thus indicated or treated with a wetting agent. In package machine dyeing, it should be noted, it is sometimes a disadvantage to use any alkali in the wetting-out process, as even a mildly alkaline bath at a high temperature has a decided tendency to shrink the yarn on the package, thus making it more difficult to obtain good penetration. Under such conditions the desirability of using wetting agents is clearly indicated.

In piece dyeing the preparation is more important, if cloudy dyeings are to be avoided. The size should always be thoroughly removed by the use of a desizing preparation and a caustic boil may be an advantage, although this is not necessary in most cases. In continuous dyeing, the substitution of caustic soda for soda ash in the dyebath will clean the goods to a very considerable extent.

There is no exception to the rule that all sulfur colors should be dissolved in a more concentrated sodium sulfide solution than is used in the dyebath itself. Up to a certain point the efficiency of solution of the dyestuff in sodium sulfide is directly proportional to the concentration of the sulfide. In other words, from the point of view of solution alone, the use of half as much sulfide as color in one gallon of water will give a more complete solution than will be obtained by the use of twice as much sulfide as color in ten gallons of water. Under average conditions, the concentration of the dissolving bath should not exceed one pound of dyestuff per gallon of water. The water is added to the dyestuff, which has been mixed with the necessary amounts of sodium sulfide and soda ash, and the mass vigorously boiled for about ten minutes to ensure the complete solution of the dyestuff. With some of the sulfur browns and yellows which are rather difficult to dissolve, it is advisable to add first only about one-half the total amount of water, boil up for a few minutes, then add the rest of the water necessary to dissolve the dyestuff and boil again. With the exception of one or two dyestuffs of the type

of Sulfogene Indigo Blue G Conc., all sulfur colors should be dissolved at a full boil.

Unfortunately, from the dyer's point of view, the sulfur dyestuffs on the market present a wide range of solubilities. The sulfur browns are as a rule difficult to dissolve, requiring relatively large amounts of sodium sulfide to effect their complete solution, while the sulfur greens at the other end of the solubility scale require very little. A combination of dyestuffs which vary considerably in their solubilities should be avoided if possible, but at times such a combination is necessary. Then it is usually preferable to utilize the optimum conditions for each color by dissolving the component parts separately, mixing them together just before running into the dyebath. This means a little extra trouble, but will pay in the long run in economy of dyestuff and improved uniformity and levelness of the dyeing.

Under average water conditions, about one-third as much soda ash as sulfide is required in medium to heavy dyeings. In very light dyeings the proportion would of course need to be somewhat larger to hold a proper concentration in the dyebath. The chief purpose of the soda ash is to maintain the alkalinity of the dyebath, thus inhibiting the decomposition of the sodium sulfide and of the dyestuff itself during the dyeing period, but it is also an aid in softening hard water.

In the dyebath proper, the factor most influencing the sulfur color group is probably the temperature. Once a shade has been established, every effort should be made to maintain a constant temperature in each succeeding bath. While many of these dyestuffs will dye quite well over a wide range of temperatures, a number of them, notably the sulfur Bordeaux, are very sensitive to any temperature variation. Especially in dyeing sulfur browns, variation from batch to batch is quite often directly traceable to variation in the dyeing temperature. In the selection of dyestuffs for combinations, care should be taken to avoid combining a color giving its optimum result at a high temperature with one most satisfactorily dyed at a low temperature. Where it does become on occasion necessary to use combinations made in this way, temperature control is particularly important, since the best way to handle such situations is to start at a low temperature and gradually raise it. The rate of increase must always be the same to arrive at the same result. As a matter of fact, automatic temperature control equipment should have a more extensive use in sulfur color dyeing than is at present the case, and in continuous piece dyeing an installation is almost essential on both the color and after-treatment boxes.

The oxidation of sulfur color dyeings, while simple on its face, can yet give rise to considerable difficulty. In fact we are not sure that a true oxidation takes place at all with a majority of these colors, and what we are accustomed to call oxidation may amount merely to the destruction or removal of the sodium sulfide used to bring the dyestuff into solution.

Under present conditions in plant operation, the old method of oxidation by exposing the goods to the air is usually no longer practicable, and recourse must be had to various methods of chemical oxidation, carried out most commonly by the use of such agents as sodium perborate, or a mixture of sodium bichromate and acetic acid. The oxidation may also be effected by washing for a considerable period of time in cold water and, where possible to use, this is the superior method, giving results most nearly approximating those obtained with the old air oxidation which so far no strictly chemical oxidation has been able to equal. The cold water method can usually be used to advantage on raw stock dyed in various circulating types of machines, and on skein yarn, and should be so employed wherever possible. With sulfur blues, for instance, it is an almost sure preventative of bronzy streaks. It is not ordinarily possible to use it on machines for dyeing yarn in the package, as the first cold wash, while fixing the dyestuff on the outside of the package almost immediately, may become so impregnated with sodium sulfide and so warm by the time it reaches the center of the package that a light center is quite likely to develop. On this type of machine, the sodium perborate method is probably the best under nearly all conditions. In piece goods dyeing, the oxidation is usually carried out by running through one box of cold water, followed by a box of sodium bichromate and acetic acid at temperatures of from 160-200° F. This gives an efficient oxidation and furthermore helps in preventing any further change in shade after the goods have been washed and finished. In this connection we may say that any excessive shade change after the goods have been finished is usually caused by leaving the goods in a slightly alkaline condition and may be minimized by leaving them neutral or slightly acid in reaction. It is to be noted that, generally speaking, the slower the oxidation the better the results in the fastness and levelness of the dyeing.

The most important operation in the dyeing of cotton with sulfur colors is the wash after dyeing, and this is the operation most generally slighted. After the dyer has prepared his goods, dyed them with the greatest care and attention to detail of which he is capable, he is more than likely to destroy all of the results of his work and skill by an insufficient wash. A very large proportion of all the complaints on sulfur-

dyed fabrics which have come to the writer's attention has been traceable to a poor wash at the end of the dyeing. An astonishingly large number of defects are caused by well-meaning attempts to increase production and effect a saving by cutting down on the time of washing. This is equally true on raw stock, yarns and piece goods. Among the troubles which may arise from this cause are excessive change of shade after dyeing, harshness, lack of brilliancy, poor fastness to washing and cross-dyeing, tendering of the goods, bad odor, fires in the dryer, and while it is possible for some of these defects to arise in the earlier stages of the dyeing, mostly they are locatable in the final wash. No sulfur-dyed goods should ever be taken from the machine until every trace of loose color and sulfide has been removed, and to do this effectively requires not less than one cold wash, two hot washes and a final cold wash.

Sometimes a dyeing which matched the standard perfectly in the dyehouse will, upon examination a few days or weeks later, be found entirely off-shade. A certain amount of shade change is inherent in sulfur colors, and is as a rule allowed for, but at times this change is out of all reason. Recent work has indicated that it is caused by leaving the goods in an alkaline condition and that it can be practically always avoided by washing until the wash water is neutral to brilliant yellow paper. In combinations for sulfur browns, where it is necessary to use the sulfur Bordeaux as shading agents, it is wise in addition to use a small amount of acetic acid, usually about one-half of one per cent, in order to make absolutely sure that every trace of alkalinity is neutralized.

In the case of raw stock too harsh to be successfully spun, a thorough wash will always avoid the difficulty, and it is also helpful to use 2-3 per cent of salt in the last wash water and dry it into the stock. Complaints are sometimes received that yarns which have been dyed in raw stock with sulfur colors are too harsh to be knitted. This is practically always caused by lack of sufficient washing, and the same can be said when a lack of fastness to washing and cross-dyeing develops. In fact, recent experience tends to show that any yarn intended for cross-dye work should be given a light soaping after dyeing and this is particularly true where the yarn is dyed on package machines, as it is almost impossible to obtain a thorough wash on this type in a reasonable time.

Tendering usually develops in the case of Sulfur Black. Although the cause for this tendering is not fully understood, to the best of our present knowledge it is due to an actual breaking down of the Sulfur Black molecule, which releases minute quantities of sulfuric acid and thus brings about tendering in the course of time. Almost any Sulfur Black dyeing will tender if it is stored for a sufficiently long period. In general practice the goods are sold and put into use rather immediately, and the washing which they receive in ordinary wear prevents tendering, as the acid is washed out about as fast as it is formed, but we know of no way to absolutely prevent the tendering of Sulfur Black if it is stored for long periods of time. However, a number of things tend to accelerate the tendering. Several metallic salts, and particularly those of copper, will cause the goods to tender very much more rapidly than they normally would. There is reason to believe that sodium sulfide will have the same effect, although this may probably be due more to the impurities usually contained in it than to the action of the pure sodium sulfide itself. Storage in warm warehouses, and the absence of air, is likely to produce a similar result, and no inadequately washed dyeing of Sulfur Black can be expected to last for any considerable length of time without tendering. However, while there is no panacea for this trouble, we can say with confidence that any Sulfur Black dyeing which has been carefully and thoroughly washed is not likely to give trouble because of tendering under any reasonable condition. It should receive a cold wash, followed by at least two hot washes at 140-160° F., then a final cold wash and also a treatment in the last wash water with about 1-2 per cent of sodium acetate which is dried into the goods. The sodium acetate left in the goods will neutralize the mineral acid as it is formed, with the formation of acetic acid and sodium sulfate. The sodium sulfate is inert, while the acetic acid is volatile and will usually evaporate before it does any damage. At all events, it is much less harsh in its action on the fiber than the sulfuric acid which is likely to be formed.

In the time at my disposal tonight it has not been possible to do more than skim the surface of the subject of the sulfur dyestuffs. It is to be hoped, however, that enough has been said to indicate that the field of sulfur color dyeing is sufficiently fruitful, in view of the tremendous usefulness of these dyestuffs, to repay the closest attention to their peculiar properties and to merit the careful consideration of the dyer using them.

RHODE ISLAND SECTION

Date: Friday evening, October 31, 1930.

Place: Rooms of the Providence Engineering Society, 44 Washington St., Providence, Rhode Island.

Speaker: Mr. G. M. Halberstadt of the Research Department of Procter & Gamble.

Subject: Textile Soaps.

A. NEWTON GRAVES, *Secretary.*

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
Professor of Chemistry and Dyeing, Lowell Textile Institute
Directing Editor

BLISS MORRIS JONES
Managing Editor

MYRON DREW REESER
Advertising Manager

Published biweekly by
HOWES PUBLISHING CO., INC.
440 Fourth Avenue, New York City

A. P. HOWES, President — M. D. REESER, Secretary — H. F. CRAWFORD, Treasurer

Subscription price $5.00 per year; Canadian $5.50; foreign $6.00

Vol. XIX November 10, 1930 No. 19

THE JOURNALS AND RESEARCH

FEW realize the vast influence which the various technical journals have on research. One that stands out is the way they have been sponsoring research for the past few years. However, this phase of their influence is distinctly secondary. Their principal contribution to research is the vast amount of edited and correlated results of various scientific investigations which they have preserved for future use.

There are but three ways in which scientific knowledge is spread: word of mouth, books and technical journals. Word of mouth is very much restricted, and to a large extent knowledge of this sort is obtained in the institutes of higher learning. Books are usually looked upon as the stronghold of knowledge, but for research their use is limited. Very rarely are the results of any recent investigations found in books. The reason, of course, is that the demand for such a book would not be large enough to warrant its publication. The journals then, are almost the only source of information about recent investigations. Certainly they are the most important.

Bibliochresis, the scientific use of the literature, is the basis for most research work. An investigation, no matter what kind, must be made methodically which means, that first of all, it must be conducted in the light of the work that has already been done. In other words, bibliochresis is the very foundation of scientific research. It enables the worker to find out the experiences of his predecessors, and it enables him to predict the results of his labors or gives him the ability to plan further research along the same or similar lines.

The industrial research man has problems all his own. He must use his time to the best advantage, and oftentimes he must work in libraries which are not exceptionally complete. This latter condition is being rapidly improved as companies realize more and more the value of a good reference library. The industrial scientific literature is most difficult to follow; both the pure and applied science publications must be examined, the patent literature must receive an especially close search, there are oftentimes veiled meanings, and finally, the information for which one is searching may never have been published.

In connection with the last, it would be ideal if all scientific investigators published, in the journals, the results of their work. In the past, probably a very large percentage of valuable research information has never been recorded—at least it has not been recorded so that the world might benefit by it. All this information then, has been lost in so far as it might help to keep a worker from repeating work that had already been done. The prospective writer might say—what good will it do me to publish the results of my work? The answer to that question is, that it will do him personally no exceptional amount of good. However, it is only by experimenters publishing their works that the industry can grow in the way it should. Then, too, there is a certain amount of direct benefit such as the money paid for a good article and the prestige which the publication of a good work brings.

The importance and value of bibliochretic work is shown by a number of facts. Most of the universities and technical schools are giving courses in bibliography. There is a steadily increasing demand for trained bibliographers in the research laboratories. Much work is being done on the indexing of all the technical articles. The indexes to the journals have a wide distribution.

Today the scientist is one of the most important factors in the economic development of the country and he can best fulfill his duty by making continued progress instead of wasting his time rediscovering facts that have already been recorded in the journals. As the literature keeps increasing, more and more study is required to cover a subject. However, the old phrase "a stitch in times saves nine" truly applies. A day's work in the library may save a week in the laboratory.

THE AMERICAN RED CROSS

At this time, with the announcement that the Red Cross will begin annual enrollment of members on November 11, Armistice Day, it is pertinent to mention some of the organization's yearly activities, particularly those of the past year.

First, and most important of all, it stands ready to rush emergency aid following disaster. In the past year the Red Cross extended such aid in 38 States, in eight of which relief was given on three occasions.

Second only to disaster relief, an important Red Cross service is assistance to disabled veterans, and special services to men still on active duty. In the past year the organization maintained trained workers in 64 Veterans' Bureau and Government hospitals for this duty, and in

368 camps, army posts and naval stations at home or on foreign service.

As a special service to the industrial world, the Red Cross trains First Aid groups. The past year saw 74,437 certificates of qualification issued to men and women trained in First Aid, a record for any year since the war.

Of value to industry and the home are Red Cross health aids, exemplified by the Public Health Nursing Service; instruction in Home Hygiene and Care of the Sick; and instruction in Nutrition, or Food Selection. A vast reserve of qualified nurses is enrolled for call in any national emergency or disaster, though these nurses at other times are engaged in their own private practice.

These highlights in the all-year work of the organization explain why a nation-wide enrollment of members is asked by the Red Cross; its work derives support from membership, and every member shares, through his support, in all Red Cross service.

EXTRACTORIALS

Faith in the industry will raise that percentage. Stop whining about high salaries of employees, the vast quantity of supplies required, etc. Get that business which the other fellow never had or even sought. It's there waiting for you, and you'll get it if you have that proper degree of faith in the industry, or differently expressed —confidence in your own ability to be a producer.—*Cleaners and Dyers Review.*

An unusual item, for this time, was published in the daily newspapers last week, to the effect that the Liberty Garment Co., of Kansas City, had increased the wages of their 450 employees about 25 per cent, and had added 150 more workers to their organization. A. B. Passman, president of the company, is quoted as saying:

"At least one large employer told me he also would increase wages. He sees it just as I do, that if we all keep crowding wages down, our customers soon will have nothing with which to buy our products. I believe others will fall in with the idea. At least it is going to be interesting to watch what follows this experiment."—*Suffern in Daily News Record.*

If a manufacturer is one of those fussy mid-Victorian individuals who refuse to accept orders below cost, it would seem rather important that he know what his cost is.

If, on the other hand, he belongs to the group of serious thinkers who believe it is cheaper to accept orders below cost than to curtail, he might be expected to be mildly interested in the extent of the loss involved in accepting those orders.

Moral: Whether you are making or losing money, accurate cost methods are handy things to have around the mill.—*Textile World.*

Many of the finishers evidently have been panic-stricken this year. Last year there was a rush to put in additional printing machines, and this year, during a halt in the activity, worries about grief that was thought likely, interfered with usual mental processes. Certain popular priced prints, such as the percales, now give promise of being in even greater demand next year than they have been in the past year. The reaction from the popular-priced dress manufacturer has made this seem certain. In some of the better merchandise, it is known that prints will be as big in 1931 as they have been during the past two years. Prints are expected to be most important in the sheer goods, whereas on other merchandise, such as the crepes and heavier goods, they will sell well, but the plain shades are going to come up into greater importance.

Price cutting is not going to help the situation. There is a definite trend which cannot be swerved by price cutting.—*Daily News Record.*

Concentration on important fundamental fiber research has very nearly smothered the manufacturing side. Although pure research work, in the long run, produces results which have a definite bearing upon the production of fabrics, this does not justify the contention that the staff at Torridon should devote some part of their time to design and fabric production. If it be true that more attention should be given by some organization to the development of designing, weaving, and so on, then it is a matter for consideration, but it can hardly be regarded as a legitimate ground for criticism of the work of the Research Association. Pure research is a totally different matter from designing and weaving.—*H. Hardy, Pres. Textile Teachers' Assn. in Textile Argus.*

Evidence of the progress made in the British dyestuffs industry since the Dyestuffs Import Regulation Act went into effect in 1920 is contained in the 1930 report of the British Dyestuffs Industry Development Committee. British imports declined from 41,203,000 pounds in 1913 to 6,686,288 pounds in 1921 and 4,690,336 pounds in 1928. The latter figure comprises about 1,600 different dyestuffs. The total output has advanced from 23,832,967 pounds in 1922 to 50,960,472 pounds in 1928—an increase of 114 per cent. Exports since 1921 have fluctuated, the total for the year 1928 being 11,648,000 pounds, which approximates the 1924 figure. Domestic production furnishes about 93 per cent of the quantity and 81 per cent of the total value of the consumption. The report further states that vat colors were not made in the United Kingdom in 1913, whereas in 1928 the output of this class alone—exclusive of indigo—totaled 1,877,172 pounds which represented 64 per cent of the domestic requirements for that year. (*Alfred Nutting, Office of the Consul General at London*).—*World Trade Notes.*

Fire Resisting Rayon Goods

By **FRED. GROVE-PALMER, A.I.C.**

IT HAS been well said that Fire is a good friend but a dangerous enemy, and when we come to consider the large number of domestic fires that occur in many different parts of the world because the draperies and hangings become ignited, it is easy to see that some method of making these fire resistant is decidedly valuable.

Rayon is increasingly used for the decoration of the home, and those manufacturers of broad stuffs who put these goods forward as being "fireproof" can readily score many points over others who can make no such claims. As a matter of fact, it is not too much to say that it should be one of the International Fire Regulations that all materials used for curtains, bed hangings or coverlets, blinds, and drapings of every kind should be made fire resistant. The curtain that wafts into the bedside candle, the hangings that receive the carelessly dropped match or cigarette end and many other trivial accidents in the home have led and still do lead to expensive and often fatal fires.

There is no difficulty in making rayon fire-resistant; plenty of common and cheap chemicals can be brought into use among which are the ones named below:

Sodium sulphate, phosphate, silicate and tungstate, common salt, salammoniac, borax, alum, etc., etc.

These could not all be used indiscriminately because some of them would be found to spoil the colors of dyed materials; some which are useful on silk, for instance, could not be used for rayon goods, and the strongly alkaline reaction of sodium silicate might be considered too active for use with either of the two fibers. In any case, when testing out the qualities of a fire-resisting compound, trials would only be made on small swatches of the material when the effect upon the color will be readily observed.

It will have been noted that "fire resistant" is the term applied here to the results obtained by treating rayon goods and others with various chemical solutions. This word is preferable to the more common "fireproofing" because such treatment does not render the fabric proof against fire in the same sense that asbestos is proof against fire. They will burn, even after treatment, but not so readily and it is in this early resistance to ignition that the great value of the process lies. When the house is a raging inferno of flames it does not matter a bit whether the curtains catch fire or not, but it does matter if the curtains will resist the first attempts of the candle flame to set them on fire. Therefore, whether the word used is "proofed" or "resistant" the meaning is the latter.

An old recipe that has been used on many different kinds of fiber long years before rayon came into existance, has also proved very useful in the new connection. This consists of a mixture of phosphate of soda and tungstate of soda, either with or without the addition of some chloride of ammonia. There are numerous variants of the formula all of which are probably equally effective, and their application is easy: all that is needed is thoroughness. For factory scale work the impregnation is done in a padding machine or in a mangle with suitable apparatus for taking up the wetted cloth and handling it into the drying chamber. It can also be worked in ordinary dye becks and then hydroextracted. In this case the liquor whizzed out will be collected for subsequent use. Some people make one bath containing the two, or three, chemicals; others prefer to do it in two stages. Either process is simple but practical experience has given good results with the two-bath process and that is the one described. The goods pass first through a 10 per cent solution of sodium phosphate in warm water and after being squeezed or wrung, go into the second bath containing 2 per cent of sodium tungstate and, if desired, half of one per cent of ammonium chloride. One is a little inclined to look upon this last addition rather in the light of a "magic touch" on the part of the older users of the recipe, though theoretically, the chloride is useful enough in larger quantity. Fabrics which have been proofed in both ways do not seem to differ very much in their powers of resistance.

A solution, which has been recommended by a municipal authority that interests itself strongly in the subject of rendering the decorations of dance-halls and theatrical scenery as resistant to fire as may be possible, is the following:

Boric acid	2½ pounds
Borax	3 pounds
Water	6 gallons

This, it will be seen, is innocuous to a large number of dyestuffs and would not affect adversely the most delicate fabric while it certainly gives a measure of protection from inflammability that would be useful for hangings, drapings, scenic effects and properties in any place where entertainments attract large numbers of people. The treatment of the cloth when using this solution is the same as that already described.

Cloths of a heavier nature, such as taffetas, brocades and repps, though not easily inflammable, may be rendered still more resistant by impregnation with the solution here given:

Ammonium chloride .... 6 pounds
Ammonium phosphate .. 3 pounds
Water ..... 6 gallons

This is a pretty concentrated solution, and that being so, there will be noted a tendency on the part of the chemicals to crystallize out, which would not permit use of this method of proofing in the home on account of its unsightliness. In public places of entertainment, however, this would not be of such importance when compared with the added margin of safety obtained. The method of application does not vary from that already described.

The majority of inventors of fireproofing compounds seem to have a strong liking for the phosphates of the alkaline metals, usually choosing the sodium salt and more rarely the phosphate of ammonium. The reason for this is well known to workers with silk and also with rayon, being that the fibers of both will readily absorb quite large percentages of phosphate. This fact is taken advantage of, of course, in the ordinary tin-weighting process which, in addition to its normal purpose is, incidentally, a very efficient method of making the material fire-resistant; tin-weighted silk is exceedingly difficult to ignite, and even then only burns when the source of heat is maintained.

A similar effect may be produced in rayon fabrics without going to the lengths demanded by the tin-weighting process if the plan outlined below is adopted:

First step: The cloth is padded through a lukewarm liquor consisting of one per cent of calcium chloride in water.

Second step: The batch is wrung out and without any washing is passed right into a warm bath made up with 10 per cent of sodium phosphate. The speed of the cloth through this bath should be reduced as much as possible in order that the reaction between the two compounds may have a fair chance of taking place, resulting in the deposition within the fiber of an insoluble phosphate of calcium. Sometimes there is a slight degradation of the color but in most cases this can be overcome by making a choice of suitable dyestuffs.

Occasionally, there arises a demand, a very limited one it is true, for a fabric that shall be both fireproof and waterproof. One customer explained the request by saying that if our fireproofing was successful he did not want to have the material damaged by the water from the firemen's hose. It was explained to him that if matters got that far it would probably not matter much which way the fabric got injured. There has been, however, an occasional call for the two properties in order that the fabrics may be resistant to either influence separately. Obviously, if the fireproofing chemicals are soluble in water the effect of water will be to spoil the resistance in the other direction; it is necessary, therefore, to aim at covering the fireproofing treatment with another that shall be waterproof.

This can be done quite easily and very effectively by passing the cloth, still damp from treatment with any of the phosphate baths previously mentioned, through a liquor containing 5 per cent of aluminum acetate. It is a good plan to increase the quantity of phosphate in the last bath of the fire treatment so that there is sure to be an excess of that salt in the fiber with which the aluminum acetate can react to form aluminum phosphate; this has considerable waterproofing properties and the material may be slowly air-dried and afterwards passed through the drying chambers at a temperature ranging from 72 to 82 deg. C. The reaction takes place slowly, which fact is the reason for the prolongation of the drying process. A still better result may be obtained by not relying upon the formation of aluminum phosphate, but by passing the material still wet with the acetate, part of which will have been converted into the insoluble phosphate, during the working and subsequent whizzing, through a solution of 2 per cent of high grade neutral oil soap in warm water. This gives an insoluble aluminum compound of the fatty acid, an aluminum soap, in fact, which has excellent water resistant qualities. When so treated and then dried at a moderate temperature the rayon fabric will be found to repel water from its surface to a very marked degree. This is a modification of one of the methods adopted by manufacturers of rainproofs. Any of the usual methods of application are suitable for this purpose though it is, perhaps, hardly necessary to mention that the more delicate rayon cloths will need careful handling during the additional processes.

In conclusion, it is requisite that a word or two should be directed to the laundries and it will be found advantageous if the manufacturers of fire-resistant goods take some means of educating both their customers and the laundries in regard to the replacement of the proofing which will be removed during the processes of laundering. Even when the proofing process is one which employs insoluble salts, such as the calcium phosphate method mentioned above, there is no doubt that apart from the possible chemical action of the washing liquors, the mechanical part of the work does tend to destroy the thoroughness of the resistance, and because of this, it will be a good plan if the laundries undertake to put this right before returning the goods to their owners. Firms undertaking the cleaning of waterproof outdoor garments make a point of reproofing them and in the same way laundries should install a sub-department for handling goods that should be fire-resistant. It will be noted from the foregoing that there is nothing very difficult or costly about the processes but there is no doubt that such service will have a great commercial value.

The Mildew Problem With Cotton and Wool Materials

By **A. J. HALL, B.Sc., F.I.C., F.T.I.**

PART II

WOOL is very susceptible to attack by bacteria and mould fungi whilst wet or damp. It may thus lose considerably in strength or undergo changes affecting its dyeing properties. In this article the nature of attack by various micro-organisms is described with reference to the substances present in the wool and the external conditions. Methods for detecting bacterial and mildew attack are described and antiseptics are dealt with.

Just as the infection of cotton materials with bacteria and mildew (mould fungi) leads to numerous difficulties in the production of cotton goods of all kinds, so does the similar infection of wool goods give rise to much wastage and loss. Wool is a nitrogenous substance and thus affords better nutriment for the growth of these micro-organisms than does cotton. The protection of wool against such attack is therefore a most difficult problem and is one which as yet has not been satisfactorily solved.

It is interesting to note that the British Research Association for the Woolen and Worsted Industries has made a bold and determined effort to ascertain the chief factors which govern the attack of wool materials by micro-organisms, and it is largely due to the research carried out in its laboratories that much of interest and importance has been discovered. But as will be indicated later, there is still the need for much further research.

Micro-organisms which attack textile materials usually flourish most satisfactorily under moist conditions. In the case of cotton, which is a comparatively dry fiber, it has been noted in the previous article that there is but slight risk from mildew attack if the moisture content of the material is less than 8 per cent. Wool has a much higher moisture regain than cotton and should therefore be more subject to mildew attack, but curiously enough it is not true that the wool fiber is actually more susceptible on this account. In fact, for rapid attack wool must be much more moist than cotton.

It will be more convenient to consider the action of bacteria and mould fungi on wool separately since these two types of micro-organisms flourish under different conditions and have differing actions on the wool substance.

An early but useful contribution dealing with the action of bacteria on wool is that of S. R. Trotman and R. W. Sutton (J. Soc. Chem. Ind., 1930, 43, 191 T). These workers inoculated sterilized woolen fabric with a culture of B. *subtilis* and incubated at 37.5° C. At the end of two days it was observed that the epithelial scales had become faint in outline and in some cases had disappeared entirely. At this stage the fabric showed less tendency to shrink; in one case shrinkage decreased from 35.4 per cent to 11.2 per cent. Also it had an increased affinity for acid dyestuffs. With continued attack by the bacillus the fabric became thinner and the scales disappeared entirely. At the end of five days the fabric was quite rotten and the spindle shaped cortical cells became detached. On boiling with water the fabric disintegrated completely and the resulting solution was shown to contain sulphides; it gave a precipitate with tannic acid, and showed the Biuret reaction. Similar results were obtained by inoculating with B. *mesentericus*.

R. Burgess (J. Text. Inst., 1924, 15, 575; 1928, 19, 315) has subsequently investigated the action of bacteria on wool very carefully. He finds that the two bacilli employed by Trotman and Sutton are very common to wool; both are actively motile and unfortunately they form spores which are difficult to destroy. Thus Brefeld has found that whereas boiling in water for 20 minutes destroys the sporeless rods of B. *subtilis*, it requires boiling for 3 hours to kill the spores. For destruction of the spores of B. *mesentericus* exposure to a current of steam for 5½ to 6 hours is required. B. *mesentericus* resists 5 per cent phenol for at least two weeks. It is this high resistance to destruction which is the cause of difficulty in sterlizing wool, for the prolonged steaming necessary changes the character of wool such that it is more susceptible to bacterial attack. The most satisfactory method of sterlization so far found consists of steaming wool for 20 minutes three times.

When bacteria act on damp wool the resulting damage is usually accompanied by formation of a yellowish-brown color. For such development it is desirable for the wool to be moist rather than absolutely wet. For instance, if a strip of wool be suspended within a test tube containing a small quantity of water so that its lower end dips in the water it will be noticed that color formation due to bacterial attack commences not in the immersed part of the strip but higher up where it is just moist. Burgess found that if such a strip was inoculated with B. *prodigiosus* it developed a pink color at the end of 6 days, and at the end of one month at 17°C., it became deep pink whilst many of the wool fibers had lost their epithelial scales. Total disintegration of the fibers required more than four months. Also the pink stain was fast to washing with boiling water soap, and dilute hydrochloric

acid; it was readily removed by dilute caustic soda. An unknown type of bacillus has been found to give violet stains, whilst B. *mesentericus* generally yields brownish stains.

The formation of color stains by the action of bacteria on wool does not always indicate marked attack of the wool substance but it frequently indicate a change in dyeing properties. Such bacteria as are most frequently found in wool appear to flourish more satisfactorily under alkaline rather than acid conditions, and it is for this reason that bacterial attack is likely to occur in scoured wool in a damp condition. In scoured wool there is usually some residual alkalinity. Whilst lying about previous to dyeing the moisture in the fabric or yarn may become unevenly distributed with consequent uneven distribution of the alkali; parts of the wool material may thus be unequally attacked by bacteria so that on dyeing afterwards, patchiness results. H. R. Hirst is strongly of the opinion from his examination of faultily dyed wool that much uneven dyeing is due to unsuspected previous attack of the wool fibers by bacteria. It is considered possible that the action of bacteria is to produce an oxidizing effect since the effects observed are similar to those resulting from oxidation.

As regards the influence of moisture in bacterial attack it is found that a higher amount of moisture is necessary for bacteria than for mould fungi. Thus bacterial attack is more often associated with wet wool materials whilst mould fungi are generally responsible for damage which occurs during storage under damp conditions.

Trade experience indicates that mildew troubles due to mould fungi are of greater importance than those due to bacteria, so that it will now be interesting to turn to this other side of the mildew problem. In contrast to bacteria mould fungi appear to flourish best under slightly acid conditions, and as a general rule mildew, due to the action of mould fungi, does not appear in wool except when it is stored in contact with air of relative humidity of 97 per cent (100 grams of dry wool then absorb 27 grams of moisture). It is thus seen that under normal conditions wool is much drier than is favorable to mildew development, since the standard moisture content is not more than about 19 grams of moisture per 100 grams of wool.

Now R. Burgess working with the British Research Association for the Woolen and Worsted Industries has discovered very many interesting and useful facts concerning the influence on mildew attack of various substances such as alkalis, soaps, and impurities such as are likely to be found in normally processed wool materials. One of the most common substances present is soap, and the influence of this will now be considered.

Soap in wool may exert an influence in a number of different ways. If it has a higher moisture absorption, it may increase the dampness of the wool containing it, and thus it may promote mildew. Soap may also exert its influence as a result of hydrolysis into alkali and fatty acid—the alkali may retard mildew growth and the fatty acid may or may not provide food for the mould fungi. Further, a soap may protect the wool substance from attack if it is more susceptible to attack than the soap. Burgess (J. Text. Inst., 1929, 20, 354) has considered these various possibilities.

An interesting observation was early made that samples of wool containing soap and showing heavy mildew growth proved to be no more damaged as regards the strength of the wool itself than wool containing little or no soap but showing a much smaller mildew growth. This would suggest protection of the wool by the soap by reason of it being more susceptible to attack. This could be proved experimentally. A large portion of worsted fabric was impregnated with a potash olive oil soft soap and dried such that it contained about 2 per cent of soap. It was then cut into four similar pieces, conditioned at 70 per cent relative humidity in a constant humidity room, inoculated (two pieces only) with spores of mould fungi, and allowed to develop a pronounced mildew growth. The two pairs of pieces were then analyzed with the following results:

	Mildewed samples		Controls	
	(a)	(b)	(a)	(b)
	%	%	%	%
Total alcoholic extract	1.69	1.59	3.48	3.51
Total fat	0.94	1.09	2.47	2.01
Total alkali (as potassium oleate)	0.49	0.28	1.85	1.72
Fatty acid as oleic acid	0.34	0.25	1.54	1.61
Unoxidized fatty acid	0.66	0.52	2.26	1.67

These figures clearly show that fatty acid is used up as a result of mildew growth.

In another experiment a cheese of worsted yarn in oil which had become mildewed during storage was used. The mildew was greater inside the cheese, and least on the outside. Extraction of the yarn was carried out with acetone and the following results obtained:

Portion of yarn		Oil content
		%
From interior of cheese (heavily mildewed)	(a)	1.41
	(b)	0.36
From outside (less mildewed)	(a)	3.32
	(b)	3.03

In a similar experiment two portions of 70's Botany tops in oil were inoculated with spores of a *Penicillium* and allowed to develop a good growth of mildew. The oil content of these portions was compared with non-inoculated portions thus:

Sample of wool		Oil content
		%
Mildewed by inoculation	(a)	1.09
	(b)	0.64
Not mildewed (not inoculated)	(a)	3.63
	(b)	3.76

Both of these experiments reveal the consumption of oil during mildew growth and it must be concluded that olive oil is a source of food for certain mould fungi.

It is unlikely that all oils or fatty substances will equally serve in promoting mildew growth and this is

confirmed by definite trials. Lower fatty acids such as caproic, caprylic and lauric acids tended to check mildew growth whilst palmitic, ricinolic, and oleic acids definitely favored rapid development of mildew. Further, mineral oils do not appear to support mildew and are therefore much less dangerous in cases of attack by mildew.

Soaps also vary in the extent to which they promote mildew growth, but scarcely any, even those claimed to be of an antiseptic nature, retard such growth. In many cases it could be shown that as a result of growth of mildew on wool containing soap a small amount of acid was formed—sufficient to change the color of bromthymol blue indicator.

A number of experiments showed that soap did not increase the moisture absorption of wool but rather decreased it. This fact is in contrast to the observation that soap is usually more hygroscopic than wool. For instance, the moisture regains of potash olive oil soft soap at relative humidities of 70 per cent and 100 per cent were found to be 22.8 and 64.4 per cent respectively whilst the moisture regains of wool itself under similar conditions were but 17 and 32 per cent. Wool fabric impregnated so as to contain 7 per cent of the soap had a moisture regain of only 28.3 per cent at 100 per cent relative humidity. Probably an explanation of these facts is to be found in the fact that in wool a soap must hydrolyze into alkali and fatty acid and the moisture regain of the whole will be dependent on the wool-soap-fatty acid complex.

A close investigation of the effect of removing impurities from scoured wool by extraction with solvents and washing with hot and cold water indicated that any process which reduced the amount of fat and soap present resulted in a less tendency to mildew. Thus hot washing was more effective than washing with cold water. The aqueous extracts were found, as was to be expected, readily capable of supporting mildew growths.

The influence of acids and alkalis on the growth of mildew is not easily elucidated since mould fungi can apparently flourish over a wide range of reaction. For instance, samples of wool were impregnated with 1 per cent sodium carbonate and 1 per cent hydrochloric acid and inoculated; it was discovered that both of the treated fabrics developed mildew to a considerable extent, the alkaline fabric the more so. Actually it is known that mould fungi can exist on wool containing 2.26 per cent of sulphuric acid or 2 per cent of sodium carbonate. It is thus unlikely that the impurity content of ordinary wool materials will prevent mildew growth because of their acidity or alkalinity. Neutral substances such as Turkey red oil, Monopol Brilliant Oil, and glycerine which are to be sometimes found in finished wool goods act favorably towards mildew.

As previously mentioned, mildew or bacterial attack of wool materials reveals itself in a destruction of the epithelial scales and in extreme cases a distintegration of the cortex occurs. The extent of the damage may be determined by means of Pauly's reagent which consists essentially of an alkaline solution of the para-sulphonic acid of diazobenzene. This reagent reacts with the tyrosine present in the wool substance to give a brownish red color. Since there is no typrosine in the epithelial scales the brown color only forms where the scales are loosened or removed as a result of mechanical damage or bacterial or mildew attack.

Pauly's reagent is prepared as follows: 2 c.c. of concentrated hydrochloric acid are carefully added to a mixture containing 10 c.c. of a 10 per cent solution of the sodium salt of sulphanilic acid and 5 c.c. of an 8 per cent sodium nitrite solution. In the test, the wool (C. Rimington; J. Text. Inst., 1930, 21, 238) is wetted in 15 c.c. of a 9 per cent solution of sodium carbonate and the freshly prepared diazo solution added.

Pauly's solution is not stable, and for this reason Sieber (Textilber, 1928, 9, 327) has utilized simply a 1 per cent solution of Benzopurpurine Red 10B. The wool is boiled for one minute in this solution and the damaged parts of the wool fiber thereby become stained red.

In carrying out such tests for the detection of wool damaged by bacteria and mildew it must be remembered that a large proportion of normal wool fibers have been locally damaged during their mechanical treatment. Such damage is likely to be confused with bacterial damage.

As indicated in the previous article a suitable antiseptic (Shirlan) has been discovered for cotton goods. An all-round suitable antiseptic for wool has yet to be found. Such substances as phenol, formalin, salicylic acid, acid potassium fluoride, and benzoic acid exert a protective effect but are not generally applicable to wool materials. At the present time sodium silico fluoride is the most useful antiseptic and is suitable for use in the conditioning of yarn and in the treating of scoured fabric which is required to remain damp for a time. But it is hoped that further research will ultimately result in the discovery of the universally applicable antiseptic which is required.

Willard Dow Heads Chemical Plant

At a special meeting of the board of directors, October 21, Willard H. Dow was appointed president and general manager of The Dow Chemical Company, Midland, Michigan to succeed Dr. Herbert H. Dow, deceased.

For eight years Mr. Dow has been a member of the Board of Directors, and for the past four years he has acted as assistant general manager. His intimacy with organization executive policies strengthened by eleven years of practical chemical experience fit him particularly well to head this $30,000,000 chemical organization.

Mr. Dow is a graduate of the University of Michigan, having received a Bachelor of Science degree in Chemical Engineering from that university in 1919. His first act under his new title was to state that "the already well-defined policies of progressive research and the building of processes well apace of the everchanging modern demands will I am sure, continue to be the distinguishing factor in The Dow Chemical Company of the future."

The Isoelectric Point and Its Relation to Textile Chemistry*

By Thomas G. Hawley, Ph.D. and
Milton Harris, Ph.D.

Chency Research Laboratories, South Manchester, Conn.

THE proteins, silk and wool, have many properties in common besides the more general reactions common to all proteins. Their resistance to bacterial decomposition and their marked insolubility are two of the many properties which make them so valuable for textile production.

It is somewhat difficult to correlate this marked insolubility with the fact that silk and wool are amphoteric substances, that is, they possess both acidic and basic properties. However, when we consider that we are dealing with extremely large molecules or aggregates which have very few free amino or carboxylic groups, and that the acidic and basic properties of silk and wool are very weak, it seems much more logical.

The proteins are composed largely of amino acids of which glycine CH_2NH_2 . COOH is the simplest type. A very interesting point is brought out here since the properties of silk and wool are very similar to those of their constituent parts. These amino acids, like the proteins from which they are obtained are amphoteric and so ionize both as acids and bases.

With the exception of water, few ampholytes (substances having amphoteric properties) have equal acidic and basic strength. In the case of silk and wool, the acidic properties predominate. Correspondingly, it is found that they are composed largely of amino acids in which the same conditions hold true.

The relative acidic and basic strength of an ampholyte is given by its isoelectric point. This point is the hydrogen ion concentration (pH) at which the substance ionizes to give equal numbers of hydrogen and hydroxyl ions; that is, has equal acidic and basic strength. Isoelectric point determinations are generally expressed on the pH scale. Under this system, pH 0 represents a solution containing one equivalent weight of hydrogen ions and 10^{-14} of hydroxyl ions per liter, while pH 14 represents the reverse. It is obvious that the former solution will be strongly acidic and the latter, strongly basic.

Sericin or silk gum has an isoelectric point of 3.8; that is, the acidic properties are approximately 10^6 times stronger than the basic.

The most generally accepted theory of protein structure is given by Emil Fischer; namely, that proteins are composed largely of amino acids linked to one another by neutralization of the acidic group of one with the basic group of another to form a peptide linkage. Apparently not all of these groups are neutralized and it is the excess of these groups which give rise to the amphoteric properties of proteins. It is obvious that a protein with an isoelectric point below seven is one in which the free acid groups are the most numerous and strong and with an isoelectric point above seven, the free amino groups predominate. On the acid side of the isoelectric point, the protein acts as a base and combines with acids, while on the basic side, it acts as an acid and combines with bases. This is due to the fact that in acid solution, the ionization of the acid groups in the protein is repressed by the common ion effect, while in basic solution, the basic groups do not ionize. This may be used to explain why some dyes dye much better in alkaline solution than in acid and vice versa. A dye which owes its effectiveness to negatively charged ions would have a much greater affinity for silk or wool in acidic solution.

There is a great deal of discussion concerning the mechanism of dyeing. Chemical combination as we have just described it is a factor, but certainly not the only factor. Some dyestuffs are probably absorbed in the fiber, but in most cases it is very likely a combination of the two.

The isoelectric point conception may also be used to explain the solubility relations of silk and wool. Any amphoteric substance shows a point of minimum solubility at its isoelectric point. Since silk and wool have isoelectric points in the acid region, it follows that they are most stable in acid solutions. It is well known that both, and more especially wool, are more susceptible to alkali than acid action, and this is in accord with the isoelectric theory.

One of the best examples of the isoelectric reaction is the degumming of silk. Sericin or silk gum has its isoelectric point at pH 3.8. According to this theory, it should be most soluble in alkaline solution. This is the case and, therefore, most commercial degumming is carried out in a weakly alkaline solution.

The marked insolubility of silk and wool which has made them invaluable in textile materials has also hampered greatly attempts to make scientific studies. It is unfortunate that most methods depend upon preparing a solution of the substance to be studied. For this reason, very little accurate work has been done on the isoelectric points of silk and wool. In previous work by the authors[1], we were able to overcome this difficulty by dry grinding of fibroin in a ball mill and subsequent suspension in water, and also by using concentrated aqueous solutions of neutral salts followed by dialysis.

There are available a variety of methods for the determination of the isoelectric point. These are based on the fact that at the isoelectric point, the osmotic pressure, viscosity, solubility, migration of particles in an electric field, conductivity, swelling and combining power are all a minimum.

*Presented at the Cincinnati meeting of the American Chemical Society.

It is apparent that many properties of silk and wool depend largely on the acidity of the solutions in which they are placed. Knowing the isoelectric point, we can at once predict these properties. This is applicable, not only to silk and wool, but to all proteins, or to go a step farther, to all ampholytes.

[1] T. G. Hawley and T. B. Johnson, Industrial and Engineering Chemistry 22, page 297 (1930) and M. Harris and T. B. Johnson, Industrial and Engineering Chemistry 22, page 539 (1930).

Communication to the Editor

The Sub-committee on Light Fastness of the American Association of Textile Chemists and Colorists, which for several years has been investigating the fastness to light of individual dyes, is planning to extend its activities so as to include the fastness of combinations of dyes. It is well known that frequently a combination of two or more dyes exhibits a fastness to light quite different from what might be expected, considering the fastness of its individual components. Thus, Anthra Yellow GC, although of inferior fastness when dyed by itself, becomes much faster in a combination with Indanthrene Blue GCD. The Committee is collecting data on this subject, and requests anyone who has observed cases of abnormal facing of this type (where a fugitive dye becomes faster, or a fast dye becomes less fast, when dyed in combination with a certain other dye) to report them in as much detail as possible to the chairman. The Committee proposes to make a study of these phenomena in order to ascertain to what extent they affect all dyes, and if possible to discover their cause.

WILLIAM H. CADY, *Chairman.*
Sub-committee on Light Fastness.
Slater Co., Inc., Webster, Mass.,

Chemical Map of North America

This map was published by the Committee on Education and Research of the National Wholesale Druggists Association.

The map was prepared to aid in giving the general public a better understanding of the breadth of knowledge required by the retail pharmacist along chemical lines. It shows the chief areas where ores and minerals are being mined at this time. There are also illustrations showing many of the chemical industries.

On the back of the map is an index giving the names of all important U. S. P. and N. F. chemicals, also a geographic arrangement of the names of manufacturers who are members of the N. W. D. A., with a classification of these manufacturers relative to the products which they make.

Mr. Shirley took as his subject "Cooperation On A Practical Basis," and described in detail the cooperative services which the United States Department of Commerce renders to the textile industry.

General Dyestuff Releases

General Dyestuff Corporation has issued the following circulars introducing a number of new dyes:

Indigosol Violet ABBF is a new dye of the Indigosol brand. Sol.-32 describes its application and use in the dyeing of cotton, rayon and silk. On these fibers it produces bright violet shades which are said to have very good fastness to washing and chlorine and good fastness to light. Sol.-36 describes the dye and its use on wool. It is dyed on wool in an acid bath and developed with bichrome and acetic acid. The dyeings are claimed to have excellent fastness to light, washing and milling.

Neptune Green SGXA is an acid green of great tinctorial strength. It is recommended for the dyeing of wool at any stage of manufacture; also as a shading color, especially in the shoddy trade, as the shades have very good fastness to fulling. The company states that it exhausts well and, therefore, is useful for union dyeing. G-56.

Brilliant Milling Blue BA is an acid color manufactured by the General Aniline Works. It is said to produce colors on wool which are of very good fastness to water, saltwater, washing and fulling; the fastness to light being only moderate. It is stated that the dye is especially valuable for the dyeing of shoddy in combination with chrome colors, the shade being very little changed by chrome. G-57.

Indanthren Brilliant Violet 4RA is manufactured by the General Aniline Works. It is claimed to give bright reddish shades of violet which have excellent fastness to light, washing and chlorine. It is prepared in a very fine paste to make it suitable for printing and padding. G-62.

Lowell Textile vs. Upsala College

Of interest to all textile men is the only metropolitan appearance of the Lowell Textile Institute football team this fall. Lowell Textile is the only textile college represented by a first rate football team and brings a veteran team into action against Upsala College at East Orange, N. J., on Nov. 15th. Lowell has been very successful on the gridiron for several years now, and earlier this season they scored an upset victory over the otherwise undefeated team of the City College of New York. Textile is led by Capt. Ed Allard, a triple threat quarterback, who was selected as last year's "All-New England Small College" quarterback by the Boston Herald. Rusty Yarnall, the Lowell coach, is a former University of Vermont three-letter man and big league pitcher. A victory over Upsala is predicted, and will be a fitting windup to the 1930 season.

All friends and well-wishers connected with the textile industry are invited to witness the forthcoming game. The New York Alumni will be hosts to the Lowell squad at a dinner and reception after the game at the Montclair Athletic Club. The committee in charge of this affair consists of Herbert Currier, '06, William Brosnan, '26, Lawrence Gottschalck, '27, and Ira Hurd, '28.

Technical Notes from Foreign Sources

Vat Dyestuffs (Indigoid)

German Patent No. 451,720—*Gesellsch. f. Chem. Ind. in Basel* (31, X, 1927, *priority of application in Switzerland granted from* 28, VI, 1923)—Two previous patents are cited in the above; G. P. No. 108,128 covers the condensation of beta-naphthindoxyl with isatine, the products being of poor affinity for cotton; G. P. No. 203,437 covers the condensation of dihalogen derivatives of isatin, for example, dibrom-isatine, with indoxyl, the production of fast violet dyestuffs being claimed. It is expressly claimed that dihalogenated derivatives are essential for the formation of useful dyestuffs.

In this present patent, by condensing the halogen substitution products of isatin with 2-1-naphthindoxyl, a series of dyestuffs is obtained, the members of which are quite different from the violet ones of G. P. No. 203,437. They are brown solids, soluble in conc. sulphuric acid with a blue color. Their hydrosulphite vats are mostly greenish-yellow to yellow-brown, and dye cotton fast brown to olive.

Afterchrome Fast Dyeings Upon Wool

German Patent No. 451,048—*I. G. Farben-Ind. A.-G.* (29, IX, 1927)—The dyestuffs covered in the specification are mono-azo dyestuffs, whose first component is an amino-naphthol-sulphonic acid in which the amino and hydroxyl groups are not in the same ring. Such amino-compounds are diazotized and coupled as usual, to 1 mol. of resorcinol. The product is salted out and worked up as usual, and dyed upon wool and with addition of 4 per cent of sulphuric acid and 15 per cent of Glauber salt, entering at 40° C. and raising slowly to the boil, if necessary adding ½ per cent more of sulphuric acid. The bath is cooled finally to 60° C., and chroming carried out for about ½ hour (using half the weight of the goods in bichromate). The dyeings are stated to be quite fast to potting, as well as to fulling, boiling, and light.

Such products heretofore produced have been prepared from amino-naphthol-sulphonic acids with the amino and hydroxyl groups in the same ring, and adjacent to each other (in the ½ position).

Indigoid Dyestuffs or Pigments

German Patent No. 448,909—*I. G. Farben-Ind. A.-G.* (11, VIII, 1927)—Covers the regeneration of the indigoid dyestuffs from a water-soluble derivative of the indigoid dyestuffs from which the water-soluble derivative was originally prepared.

Specifically, the patent covers the saponification, properly hydrolysis, of a sulphurous acid ester of N-acylated indigos or indigoid dyestuffs, in the presence or absence of substrata. This hydrolysis may be carried out with alkaline or acid hydrolytic agents. According to the agent and conditions employed, either the acylated indigo or the unacylated product is formed. There would seem to be some point in using a substratum, upon which the dyestuff might be precipitated for pigment purposes, and this is one of the specifications; but the other specifications, of textile substrata, fibers, paper, leather, etc., and of no substratum at all, would appear, at least, to be rather a trifling matter, since dyestuffs are obviously prepared for use upon textiles, etc., and one does not convert an insoluble dyestuff into a soluble form, at trouble and expense, merely for the purpose of regenerating it in the original form. This is done, to be sure, in the purification of some dyestuffs, notably the vat dyestuffs, but the purpose in this case is to separate the dyestuff from impurities formed in the process of manufacture.

Sulphur Dyestuffs

German Patent No. 453,373—*I. G. Farben-Ind. A.-G.* (24, XI, 1927)—The basis of the procedure is formed by the indophenols or leuco-indophenols from dihydrogenated indols, their derivatives, or substitution-products. These are fused with a polysulphide, with or without a solvent or medium, though alcoholic polysulphide is recommended. The products are purified by the usual methods, and are mostly blue to violet dyestuffs.

Pigments

German Patent No. 448,858—*I. G. Farben-Ind. A.-G.* (11, VIII, 1927)—A somewhat curious procedure. Nitroso-beta-naphthol, best in the form of its bisulphite compound, is reacted with iron salts, preferably in the presence of Turkey-red oil or such substances, in the presence or absence of the substrata commonly used in the lake industry, and also in the presence of basic dyestuffs. It is recommended that a part of the alkaline reagent necessary for the reaction between the bisulphite compound and the iron salt be added before the basic dyestuff. (This procedure is really anticipated in G. P. No. 356,993). The practical result of the above is, to influence more or less the color-tone of the pigment, without at all affecting its fastness to light or alkali. Malachite Green and others of that series are particularly spoken of as suitable basics. It seems rather strange that the introduction of any of the basics of the Malachite Green series should not decrease the fastness to light, at least, of the resultant products.

Pre-Dyeing of Cotton in Union Goods with Sulphur Dyestuffs

Kurt Ulrich—Monatsch. f. Textil-Ind. 45, 127 (1930).—Since the sulphur dyestuffs must be dissolved with the help of sodium sulphide, the process for dyeing cotton in union goods is not possible in the ordinary way, since the wool would be strongly attacked in the alkaline bath. This harmful action of the sodium sulphide must at least be considerably diminished, at least, before the valuable group of sulphur dyestuffs can be used. The trouble can be lessened in the first place, if one works in a bath which is kept from going above about 30°-35° C., and in the second place, if a certain amount of sodium bisulphite is added to the bath, which has been prepared in the usual way. The action of the bisulphite can be expressed by the following equation:

$$Na_2S + NaHSO_3 = Na_2SO_3 + NaSH$$

The addition of sodium bisulphite should not exceed the amount corresponding to the equation, since otherwise precipitation of the dyestuff occurs, and hydrogen sulphide is liberated, through destruction of some at least of the sulphydrate. For 1 kilo of sodium sulphide, about 0.4 kilos of solid bisulphite would be used. In place of bisulphite, bicarbonate may be employed, but regard must then be made to the fact that the temperature of solution of bicarbonate should not exceed 50°C. at the highest, for above that temperature the bicarbonate begins to decompose into carbon dioxide and sodium carbonate, and thus so much of the effective bicarbonate is lost. Protective agents suitable for wool in alkaline media may also be added to the bath with advantage.

After dyeing, the goods are carefully rinsed, and the wool dyed in a fresh bath with acid or afterchrome dyestuffs.

(Note: we do not recall having seen any definite statement to the effect that sulphur dyestuffs as a class dissolve in sulphydrate as well as in sulphide, though the fact is hardly surprising. If it were not that sodium sulphydrate in the solid form, at least, is seldom met with, even if it is upon the market at all, it would seem as well to use the sulphydrate to start with in dissolving the sulphur colors, so avoiding the expense of the bisulphite, and the trouble of doctoring the bath.)

Wool-like Viscose Fibers

German Patent No. 438,236—*Koeln-Rottweil A.-G., Berlin* (10/XII/'26).—There are two claims made in this patent. The first requires the use of a viscose solution only so ripe as is unavoidable through the need of carrying out the unavoidable processes of solution, filtration, etc. The second claim covers the diminution of the degree of ripening by carrying out these unavoidable mechanical operations at the lowest possible practicable temperature (0°-10° C.). Cf. German Patent No. 389,394, which covers the production of wool-like fibers by using a xanthogenate ripened as little as possible. The present patent is really a corollary of the latter patent.

Contributions to Our Knowledge of the Process of Swelling and Solution of Cellulose and Its Derivatives

K. Hess — Papier-Fabrikant 28, 169 (1930).—The author has been working, in collaboration with C. Trogus, upon the cellulose-cupramine-alkali system, with the purpose of studying the phenomena of swelling and solution of cellulose fibers in the aqueous solution of a strong electrolyte. The results obtained are given in a table, from which the taking up of copper from cupramine solutions by cellulose fibers, in the presence of alkali, can be determined for different concentration. Roentgenographs also make it possible to follow up the changes which the cellulose micelle undergoes in the course of the "Verkupferung." According to their evidence, two chemically different copper-alkali compounds are formed, which are reversibly convertible into one another, in dependence upon the copper and the alkali content of the solution. The influence of the "coppering" of the fiber upon its degree of swelling is only slight, at least at sufficiently high concentrations of alkali—the increase in diameter is about 150 to 200 per cent.

Study was also made from the purely organic side; i.e., well-defined chemical derivatives, trimethyl-triacetyl- and tri-"nitro"-ramie with organic liquids. But the situation proved to be much more complex in these cases. In the regeneration of acetyl-cellulose from a pyridine solution, for example, the formation of several modifications was observed, varying according to the temperature.

See also Hess, Trogus, Ljubitsch, and Akim on "Phenomena of Swelling of Cellulose Fibers," in Kolloid-Zeitsch. 51, 89 (1930).

Viscose Artificial Fibers, Etc.

Viscose; German Patent No. 439,359 — *H. Jentgen* (8, I, 1927).—In the so-called two-bath system of spinning, in which the first or true precipitating bath contains ammonium salts (also aldehydes, with or without various sugars, vegetable extracts, etc.), the ammonia set free by the nascent alkali of the decomposing viscose requires to be removed continuously, which is both inconvenient, and also leads to loss of ammonia. By addition of formaldehyde to the bath, the ammonia set free is converted to hexamethylene-tetramine, a soluble substance, which remains in the bath without causing turbidity or precipitation. Its formation renders the bath alkaline; the bath is therefore continuously neutralized with a suitable acid, which, if the same as that entering into the composition of the ammonium salt used, simply splits the hexamethylene-tetramine into the original aldehyde, and the ammonia also "liberated" simply forms more of the same ammonium salt which essentially composes the bath. Ultimately, of course, the bath will require either dilution, because of increasing concentration, or total replacement, that the ammonia and sodium compounds may be separated, in order that they may go back into the cycle of operations.—Glucose, molasses, etc., are favorable additions to the bath.

$4,000,000 General Water Treatment Corporation

Organization of General Water Treatment Corporation under Delaware laws as a holding company to merge the interests of The Permutit Company, New York, and the Ward-Love Pump Corporation, Chicago, both specialists in equipment for the softening and purification of water, as well as in allied chemical and mechanical lines, was announced in a letter to stockholders of The Permutit Company from W. Spencer Robertson, President.

The companies in the merger have combined assets of more than $4,000,000. Mr. Robertson will be president of the corporation and Francis N. Bard, president of the Ward-Love Pump Corporation, will be chairman of the board of directors.

General Water Treatment Corporation has also entered into certain agreements pursuant to which it has the right to acquire all the issued and outstanding stock of Ward-Love Pump Corporation.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

PRIVATE SECRETARY—ASSISTANT TO EXECUTIVE AVAILABLE

Private secretary, assistant to executive, with several years' experience with a foreign and domestic dyestuff and chemical manufacturing concern, desires a position in the above capacity. Address: Classified Box No. 651, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

CHEMIST-EXECUTIVE AVAILABLE

Textile Chemist with twenty-two years' practical experience. Graduate Lowell Textile Institute. Four years instructor in Chemistry and Dyeing. Three years theoretical and practical experience in Peroxide Bleaching. Fifteen years in charge of chemical work in large textile plant. Experienced in purchase of dyes and chemicals. Excellent analyst, and one who can interpret results.

Would consider position as technical advisor to chemical or dyestuff executive. Address: Classified Box No. 638, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED

Experienced dyestuff salesman to represent manufacturer in New England. In reply state territory covered, sales per month, experience and age. Replies held in strict confidence. Address: Box No. 649, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Rayon and cotton dyer, skeins, technical training, 10 years' exceptional experience. Put your dyehouse on paying basis. All types of dyes, perfect matches, fine winding. Best references. Address: Box No. 650, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Thoroughly experienced dyer on woolens, worsteds, silks and cottons. Can dye all classes of colors. Full information upon request. Address: Classified Box No. 643, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Chemist—seven years' experience, manufacturing and research on azo dyes and sulphonated oils. Reasonable salary. Good references. Address: Classified Box No. 648, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Superintendent of Dyeing; long experience on Cottons, Silks, Rayons and all mixed fabrics. Thoroughly conversant with Basics, Directs, Developed and Vats, on Pads, Jiggs and Reels. Capable of taking charge of any piece goods dye plant. Will locate anywhere. Address: Classified Box No. 637, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

Colorist, thirty, married, twelve years' experience in laboratory of dyestuff manufacturer, doing standardizing, shade matching, and demonstrating; desires position in dyestuff manufacturer's laboratory or in a mill. Address Classified Box No. 645, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Dyer, Worsted and Woolen—technically trained man wishes to make a change about January 1st. Progressive and excellent color matcher. Has successfully managed several dye houses for a number of years, and can furnish excellent references confirming the above statement. Address Classified Box No. 644, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.